

Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 0 760 219 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.03.1997 Bulletin 1997/10

(51) Int. Cl.⁶: **A45D 26/00**

(21) Application number: **96113656.1**

(22) Date of filing: **26.08.1996**

(84) Designated Contracting States:
DE FR

(30) Priority: **28.08.1995 JP 219116/95**
03.10.1995 JP 256575/95
15.05.1996 JP 120693/96

(71) Applicant: **MATSUSHITA ELECTRIC WORKS, LTD.**
Kadoma-shi Osaka 571 (JP)

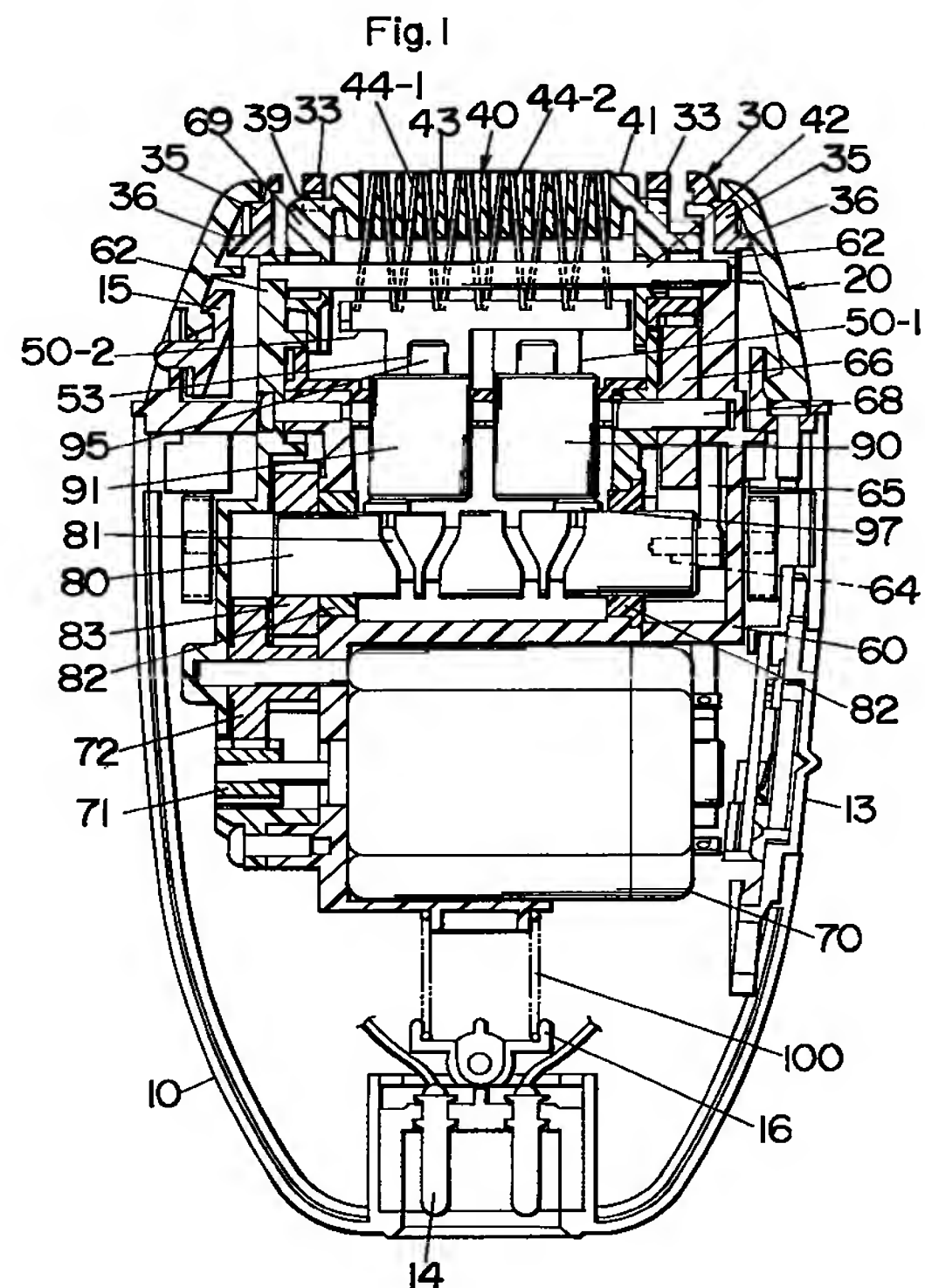
(72) Inventors:
• **Iwasaki, Jyuzaemon**
Kadoma-shi, Osaka (JP)

• **Tanahashi, Masao**
Kadoma-shi, Osaka (JP)
• **Takegawa, Yoshinobu**
Kadoma-shi, Osaka (JP)
• **Asada, Mika**
Kadoma-shi, Osaka (JP)

(74) Representative: **Goddard, Heinz J., Dr. et al**
FORRESTER & BOEHMERT
Franz-Joseph-Strasse 38
80801 München (DE)

(54) **Hand-held depilating device**

(57) A hand-held depilating device capable of masking the pain of plucking the hairs through psychological effect. The depilating device comprises housing (10) adapted to be grasped by the hand of the user and a plucking head (40) mounted on top of the housing for plucking the hairs from the skin. Stimulator is mounted on top of the housing adjacent to the plucking head (40) for providing mechanical stimuli to the skin while the plucking head operates to pluck the hairs. The stimulator comprises a vibrator (31) which provides vibrations to the skin as the mechanical stimuli which act on sense receptors other than nociceptors that respond to pain, thereby masking the pain caused by plucking the hairs or received at the nociceptors. That is, the mechanical stimuli caused by the vibrations can activate Meissner's corpuscle or Pacinian corpuscle to make indistinct to the pain as demonstrated by a gate-control theory in psychology. Thus, the mechanical stimuli applied separately from the plucking operation can excite the tactile or pressure sense receptors so as to activate the gate control path at posterior horn of the spinal cord immediately before or simultaneously with the plucking the hair, thereby blurring the pain being transmitted through the nerve. Alternately, roller (160) with stimulus projections may be utilized to apply the mechanical stimuli for alleviation of the pain.



EP 0 760 219 A1

Description

TECHNICAL FIELD

The present invention is directed to a hand-held depilating device for plucking hairs from the skin of a user, and more particularly to such device having a stimulator providing mechanical stimuli to the skin for masking the pain of plucking the hairs.

BACKGROUND ART

European Patent Application EP-A-0 622 033 A2 discloses a depilating device which comprises a plucking head for plucking the hairs from the skin of a user and a smooth roller which is mounted separately from the plucking head to be in rolling contact with the skin around a portion from which the hairs are plucked by the plucking head. The roller acts to stretch the skin for alleviating pain by the effect of reducing resistance to a force of pulling the hairs. However, even with the skin stretching, there remains a problem that the pain itself may be perceived still significantly by the user.

In order to further alleviate the pain experienced at the time of plucking the hairs, the inventors study mechanism of pain including nerve systems as well as sense receptors in the skin. Through this study, it is found effective to give mechanical stimuli to the skin in order to considerably alleviate the pain caused by plucking the hairs. The present invention is accomplished based upon the above finding and comprises a depilator housing adapted to be grasped by the hand of the user and a plucking head mounted on top of the housing for plucking the hairs from the skin. Stimulator is mounted on top of the housing adjacent to the plucking head for providing mechanical stimuli to the skin while the plucking head operates to pluck the hairs. The stimulator comprises a vibrator which provides vibrations to the skin as the mechanical stimuli. The vibrations can act on sense receptors other than nociceptors that respond to pain, thereby masking the pain caused by plucking the hairs or received at the nociceptors. That is, the mechanical stimuli caused by the vibrations can activate Meissner's corpuscle or Pacinian corpuscle to make indistinct to the pain as demonstrated by a gate-control theory in psychology. Therefore, the mechanical stimuli applied separately from the plucking operation can excite the tactile or pressure sense receptors so as to activate the gate control path at posterior horn of the spinal cord immediately before or simultaneously with the plucking the hair, thereby blurring the pain being transmitted through the nerve. Further, the mechanical stimulus of vibrating nature do hardly act to rub the skin so as to assure comfortable hair plucking without causing unpleasant skin rubbing which may hurt the skin.

Accordingly, it is a primary object of the present invention to provide a hand-held depilating device which applies the vibrations to the skin during the plucking operation for effectively alleviating the pain caused by

plucking the hair.

The vibrator may comprise a vibration roller which is rotatably supported to the top of the housing and is driven by an incorporated motor to rotate. The vibration roller has a rotation axis which is eccentric from a mass center of the roller so that, as the vibration roller is driven to rotate while moving the plucking head across the skin, the vibration roller generates vibrations which are applied to the skin. Thus, the vibratory mechanical stimuli can be generated with a simple eccentric structure, which is therefore another object of the present invention.

The vibrator is preferred to vibrate in a direction perpendicular to a general surface of the skin for giving the mechanical stimuli effectively to the skin, which is therefore a further object of the present invention.

The vibrator is carried on a skin guide frame which is floatingly supported to the housing together with the plucking head so that the vibrator can easily follow the various portions of the skin while manipulating the plucking head thereacross. With this result, the mechanical stimuli can be applied effectively and uniformly to the skin, which is therefore a still further object of the present invention.

Further, the skin guide frame is supported to be capable of swinging about a swing axis while it is depressed together with the plucking head. With the combination of the depressing and swinging movements of the skin guide frame relative to the housing, the vibrator on the skin guide frame can easily follow the various portions of the skin while manipulating the plucking head thereacross. Thus, the mechanical stimuli can be applied effectively and successfully to the skin. In order to achieve such sophisticated movement, the skin guide frame is engaged on a rounded portion of the housing at a point of contact defining the swing axis. As the skin guide frame swings with an attendant depression thereof, the point of contact is made to move along the rounded portion.

The housing is preferred to have a restrictor which is associated with the vibrator to restrict an effect or extent of vibration to be applied to the skin. The restrictor is positioned immediately adjacent to the vibrator and comes into contact with the skin together with the vibrator so as to restrict an extent to which the vibrator is pressed against the skin. Therefore, the vibration of an optimum amplitude can be applied to the skin. The restrictor is connected to variably adjust the effect of the vibration or adjust the amplitude of the vibration to be transmitted to the skin in accordance with varying locations of the skin or the user's preference for maximizing the effect of alleviating the pain, which is therefore a further object of the present invention.

The vibrator may includes a skin contact member or applicator which is detachable to the vibrator. With the use of a plurality of skin contact members of different stimulating characteristics, the user can select one of the skin contact members which is optimum for each individual user or for different portions of the skin.

In another embodiment of the present invention, the stimulator comprises a roller with a plurality of stimulus projections which provide the mechanical stimuli to the skin as the roller is caused to rotate in contact with the skin. The mechanical stimuli thus produced separately from the plucking operation can excite the tactile or pressure sense receptors so as to mask the pain caused by plucking the hair in the same manner as discussed hereinbefore. As the plucking head is manipulated across the skin, the roller is caused to rotate so that the stimulus projections apply the mechanical stimulus. In this manner, the mechanical stimuli can be obtained with a simple mechanism of using the roller, which is therefore a further object of the present invention.

The stimulus projections are preferably in the form of bristles projecting radially from the roller.

Preferably, the roller is carried on a skin guide frame which is floatingly supported to the housing so that the stimulus projections on the roller can easily follow the various portions of the skin while manipulating the plucking head thereacross. With this result, the mechanical stimuli can be applied effectively to the skin, which is therefore a still further object of the present invention.

An adjusting mechanism is provided to adjust a projection amount of the stimulus projections from the top of the housing so that the user can select optimum mechanical stimulus for alleviating the pain. In addition, the roller may be detachably mounted to the housing so that it can be replaced with another roller of different stimulating characteristic. Thus, the user can select optimum stimulation effect for various portions of skin and for her own preference, which is therefore a further object of the present invention.

In a preferred embodiment, the plucking head is floatingly supported to the housing to be capable of being depressed and is surrounded by a skin guide frame. The skin guide frame comprises a main body which is connected to the plucking head to be capable of being depressed together therewith and a front guide which is movably supported to the main body for limited displacement relative to the main body. The roller is supported to the front guide so that the roller can be depressed for a limited extent independently of the plucking head after which it can be depressed together with the plucking head. In this manner, the roller can well follow the contour of the skin while manipulating the plucking head thereacross, thereby enhancing the effect of the mechanical stimuli for alleviation of the pain, which is therefore a further object of the present invention.

Further, the skin guide frame is supported to be swingable about a swing axis while it is depressed together with the plucking head. With the combination of the depressing and swinging movements of the skin guide frame relative to the housing, the roller on the skin guide frame can follow the skin more precisely while manipulating the plucking head thereacross. Thus, the

mechanical stimuli can be applied effectively and successfully to the skin for further enhancing the alleviation of the pain. In order to achieve such sophisticated movement, the skin guide frame is engaged on a rounded portion of the housing at a point of contact defining the swing axis. As the skin guide frame swings, the point of contact is made to move along the rounded portion of the housing in a direction of facilitating an attendant depression of the skin guide frame together with the plucking head. Thus, the roller carried on the skin guide frame can follow the skin more conformably to achieve superior effect of alleviating the pain.

These and still other objects and advantageous features of the present invention will become more apparent from the following description of the embodiments when taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front vertical section of a depilating device in accordance with a first embodiment of the present invention;

FIG. 2 is a top view of the depilating device;

FIG. 3 is front vertical section of a plucking head of the device;

FIG. 4 is an exploded perspective view of the plucking head and a skin guide frame;

FIG. 5 is a side section of the plucking head and the skin guide frame;

FIGS. 6A and 6B show a mechanism of driving a vibrator defined in the skin guide frame as viewed in a section taken along a line 6-6 of FIG. 3;

FIGS. 7A, 7B, and 7C show a hair plucking operation with the aid of the vibrator;

FIG. 8 is a side section showing a combination swing and depression movement of the skin guide frame;

FIG. 9 is a perspective view of an alternative skin guide frame used in a modification of the depilating device;

FIG. 10 is a side section showing the skin guide frame of FIG. 9;

FIGS. 11, 12, and 13 are perspective views respectively showing other skin guide frame used in further modifications of the depilating device;

FIG. 14 is a top view of a depilating device in accordance with a second embodiment of the present invention;

FIG. 15 is an exploded perspective view of the device of FIG. 14;

FIG. 16 is a side section of the above device;

FIG. 17 is a front vertical section of a depilating device in accordance with a third embodiment of the present invention;

FIG. 18 is a top view of the above device;

FIG. 19 is a perspective view of a vibration roller utilized in the above device;

FIG. 20 is a side section of the top of the device for illustration of a drive mechanism of driving a roller

on top of the device;

FIG. 21 illustrates the hair plucking operation with the aid of the roller;

FIG. 22 is a top view of a depilating device in accordance with a fourth embodiment of the present invention;

FIG. 23 is an exploded perspective view of the device of FIG. 22;

FIG. 24 is a side section of a plucking head and a skin guide frame of the device;

FIG. 25 is a front vertical section of the plucking head;

FIGS. 26A and 26B are side sections showing a combination swing and depression movement of the skin guide frame;

FIGS. 27A, 27B, and 27C show a hair plucking operation with the aid of a roller with stimulus projections carried by the skin guide frame;

FIG. 28 is an exploded perspective view of a mechanism of detachably mounting one of the rollers to the skin guide frame;

FIGS. 29A and 29B are perspective and sectional views of a first alternative roller which may be utilized in the above depilating device;

FIGS. 30A and 30B are perspective and sectional views of a second alternative roller which may be utilized in the above depilating device;

FIGS. 31A and 31B are perspective and sectional views of a third alternative roller which may be utilized in the above depilating device;

FIGS. 32A and 32B are perspective and sectional views of a fourth alternative roller which may be utilized in the above depilating device; and

FIG. 33 is a perspective view of a fifth alternative roller which may be utilized in the above depilating device.

DETAILED DESCRIPTION OF THE EMBODIMENTS

First Embodiment (FIGS. 1 to 13)

Referring to FIG. 1, there is shown a depilating device in accordance with a first embodiment of the present invention. The device comprises a housing 10 mounting a head frame 20 with a generally rectangular opening and a plucking head 40 disposed within the head frame 20 to be exposed through the opening. The housing 10 incorporates a chassis 60 mounting a motor 70, a positive return cam 80, and a drive mechanism for the plucking head 40. The housing 10 is provided with a power switch 13 for turning on and off the motor 70 and also with a pair of terminal pins 14 for electrical connection to an AC power adapter to energize the motor 70. As best shown in FIG. 4, the head frame 20 is in the form of a top and bottom opened rectangular frame having a pair of end walls 21 between which the plucking head 40 is received. The head frame 20 is detachably mounted on the upper end of the housing 10 by means of a hook 15 and carries a skin guide frame 30 which

comes into contact with the skin of the user for guiding the plucking head 40 across the skin.

The plucking head 40 comprises a carrier 41 rotatably supported about a shaft 42 which extends horizontally between the upper ends of the chassis 60 to define a longitudinal axis of the plucking head. The carrier 41 is formed with a series of fixed pinching blades 43 of an arcuate configuration arranged along the longitudinal axis. The fixed pinching blades 43 are made of a plastic material having some elasticity and are molded integrally with the carrier 41 to provide a unitary structure. Mounted on the carrier 41 are movable pinching blades 44-1 and 44-2 which are arranged along the axis of the shaft 42 in an alternating relation to the fixed pinching blades 43. The movable pinching blades 44-1 and 44-2 are commonly supported loosely on the shaft 42 to be rotatable thereabout together with the carrier 41 and the fixed pinching blades 43. The movable pinching blades 44-1 and 44-2 are arranged along the axis of the shaft 42 alternately to each other and are secured at their lower ends respectively to first and second sliders 50-1 and 50-2 which are slidably supported by axles 52 held in the lower end of the carrier 41 and which are driven to reciprocate in parallel with the shaft 42 but in the opposite directions to each other, as will be discussed later. The movable pinching blades 44-1 and 44-2 are formed at their ends respectively with a pair of spaced anchor legs 46-1 and a single anchor leg 46-2 which are press-fitted to corresponding notches formed in the sliders 50-1 and 50-2, respectively. Each of the movable pinching blades 44-1 and 44-2 are also formed to have a pair of side tabs 47 on the opposite sides of a hole 45 through which the shaft 42 extends. The side tabs 47 are press-fitted to corresponding grooves formed in the carrier 41 so that the movable pinching blades are allowed to swing about the individual connections of the side tabs 47 with the grooves toward and away from the adjacent fixed pinching blades 43 as the anchor legs 46 are caused to move axially by the reciprocation of the sliders 50-1 and 50-2. Thus, the movable pinching blades are driven to swing or to have the upper edges displaced axially toward and away from the adjacent fixed pinching blades 43 so as to repeat clamping the hairs between the movable and fixed pinching blades and releasing the hairs for plucking the hairs in association with an oscillatory movement of the carrier 41 about the shaft 42, the detail of which will be discussed later.

Referring back to FIG. 1, the chassis 60 supports a plurality of gears for establishing a drive connection from the motor 70 to the positive-return cam 80 as well as for oscillating the carrier 41, i.e., the plucking head 40 about the shaft 42. The positive-return cam 80 is provided in the form of a cylinder with a pair of circumferentially extending grooves 81 which are symmetrical to each other such that the horizontal distance between the grooves varies in the circumferential direction. The cam 80 is journaled at its opposed ends by means of bearings 82 in the chassis 60 to be rotatable about a horizontal axis and is operatively connected to the slid-

ers 50-1 and 50-2 by means of cam cylinders 90. The cam cylinder 90 comprises a barrel 91 supported to the chassis 60 by means of a vertical pin (not shown) to be rotatably about a vertical axis. Projecting upwardly from the barrel 91 is a pin 95 which is slidably received in an arcuate furrow 53 formed in the bottom of each of the sliders 50-1 and 50-2. The barrel 91 is also provided on its lower end with a cam follower 97 for slidable engagement into each one of grooves 81 of the cam 80 such that the rotation of the cam 80 is translated into reciprocating movement of the sliders 50-1 and 50-2 along the shaft 42 through a swinging movement of the cam cylinders 90, thereby displacing the movable pinching blades 44-1 and 44-2 in the axial direction to move their upper edge into abutment and away from the associated fixed pinching blades 43.

Thus, the rotation of the cam 80 causes the sliders 50-1 and 50-2 to reciprocate along the axis of the shaft 42 in opposite directions, thereby displacing a set of alternate movable pinching blades 44-1 in the same direction and at the same time displacing the other alternate set of the movable pinching blades 44-2 in the opposite direction. In this manner, every set of two adjacent movable pinching blades 44-1 and 44-2 are caused to swing in the opposing directions to have their upper edges abutted against on both sides of the common fixed pinching blade 43 located between the two adjacent movable pinching blades 44-1 and 44-2 in order to clamp the hairs therebetween.

As shown in FIG. 1, the motor 70 is operatively connected to the cam 80 through a reduction gear train of a pinion 71 of the motor 70, a first gear 72 and a second gear 83 fixed on one end of the cam 80. The cam 80 is linked to one end of a crank lever 65 by means of an eccentric pin 64 which is eccentric to the horizontal axis of the cam 80. The other end of the crank lever 65 is coupled to a partially toothed rack wheel 66 by means of a pivot pin (not shown) which is eccentric to a shaft 68 carrying the rack wheel 66. The rack wheel 66 is in meshing engagement with a gear 49 on one axial end of the carrier 41 so that the rotation of the eccentric pin 64 about the axis of the cam 80 is translated into an oscillating rotary movement of the rack wheel 66 about the shaft 68 and therefore the corresponding movement of the gear 49 or the plucking head 40 about the shaft 42. That is, the plucking head 40 is caused to oscillate about the shaft 42 in synchronism with the plucking movement of displacing the movable pinching blades in the axial direction of the shaft 42, and is so arranged as to complete one oscillation cycle while the cam 80 rotates one rotation about its horizontal axis such that the movable pinching blade is caused to move toward and away from one of the two adjacent fixed pinching blades during one oscillation cycle of the plucking head 40 about the shaft 42 and to move toward and away from the other fixed pinching blade during subsequent oscillation cycle of the plucking head 40. More detailed operation of the plucking head 40 is explained in the European Patent Application No. 92102760.3 and

therefore is omitted herein. However, it is noted here that the plucking head 40 is driven to oscillate about its longitudinal axis between a limited angular range such that the clamping edges of the pinching blades are caused to advance into the opening of the head frame 20 and retard inwardly into the head frame 20, during which swinging movement the hairs are plucked as being clamped between the adjacent pinching blades.

The plucking head 40 is disposed at the upper end of the head frame 20 together with the skin guide frame 30 so as to define an advancing direction along which the guide frame 30 is moved by the user in contact with the skin for successively plucking the hairs over a wide area of the skin. The advancing direction is defined to be perpendicular to the longitudinal axis of the plucking head 40 and correspond to a forward angular movement of the plucking head 40 about its longitudinal axis in which the clamping edges of the pinching blades swings about the longitudinal axis outwardly for entrapping the hairs between the movable and fixed pinching blades. That is, when moving the skin guide frame 30 in contact with the skin in the advancing direction, the plucking head 40 will follow that direction as moving forward from the behind in circumferential direction about the longitudinal axis of the plucking head 40. The plucking head 40 is additionally provided with a smooth roller 141 which extends in parallel with the longitudinal axis of the plucking head and is located forwardly of the pinching blades with respect to a direction of moving the pinching blades into contact with the skin from the inwardly retracted position, such that the roller 141 comes into contact with the skin for smoothing the skin prior to plucking the hairs therefrom.

The plucking head 40 is mounted on the chassis 60 together with the motor 70 as well as the other components establishing the driving connection therebetween so that almost all of the components are integrated into a single unit. The chassis 60 is floatingly supported within the housing 10 by means of a coil spring 100 so that the plucking head 40 can be depressed inwardly into the housing 10 to a limited extent and therefore can readily follow the contour of the skin without accompanying an excessive counter-force to the plucking head 40 when pressing the head 40 to the skin. As seen in FIG. 1, the coil spring 100 is interposed between the lower end of the chassis 60 and a stand 16 on the interior of the housing 10. The upward displacement of the chassis 60 is limited by engagement of a stopper on the chassis 60 with a corresponding part of the housing 10.

The skin guide frame 30 is disposed around the plucking head 40 for contact with the skin in order to smoothly guide the plucking head when moving the plucking head in the advancing direction. As shown in FIG. 4, the skin guide frame 30 is made of a plastic material into a unitary structure of a generally rectangular configuration having a pair of front and rear bars 31 and 32 integrally connected by opposite end bars 33. Each of the opposite end bars 33 is connected at its rear end integrally with a rigid end support 34. The end bar

33 is made thin to give a sufficient resiliency by which the front bar 31 is allowed to move substantially vertically relative to the end supports 34 with attendant resilient deformation of the end bars 33. The guide frame 30 is fitted within the head frame 20 by loose engagement of pins 36 on the end supports 34 into corresponding vertical grooves 24 in the inner surface of the end walls 21 of the head frame 20 in such a manner that the guide frame 30 is vertically movable relative to the head frame 20. The end support 34 is formed integrally with bearing projection 35 from which the pin 36 projects. The bearing projection 35 has in its lower end with a recess 37 into which a shoulder 62 at the upper end of the chassis 60 engages, as shown in FIGS. 1 and 5, such that the guide frame 30 can be depressed together with the chassis 60, or the plucking head 40. In other words, the guide frame 30 is floatingly supported together with the plucking head 40 by the coil spring 100, so that the guide frame 30 and the plucking head 40 can be depressed together relative to the housing 10.

The front bar 31 of the skin guide frame 30 is formed with a series of comb projections 130 which come into contact with the skin for lifting and smoothing the hairs prior to plucking the hairs. The rear bar 32 is provided with a smooth roller 131 for facilitating the skin guide frame to move across the skin. The roller 131 is rotatably supported about a shaft 132 fixed to the rear bar 32. Each of the end bars 33 is provided intermediate its length with a cam projection 39 which is engageable with each of toothed wheel 69 formed on opposite axial ends of the carrier 41. As the plucking head 40 rotates or swings about the shaft 42, the cam projection 39 rides up and down the teeth of the wheel 69, as shown in FIGS. 6A and 6B, so that the end bar 33 acts as a pawl to thereby vibrate the front bar 31 in a direction, as indicated by an arrow in FIG. 5, i.e., in the direction generally perpendicular to the surface of the skin. The resulting vibrations are applied as mechanical stimuli to the skin from which the hair are being plucked, thereby masking the pain of plucking the hair to alleviate the pain. Thus, the front bar 31 is defined as a vibrator which provides the mechanical stimuli through the comb projections 130 to the skin as the plucking head 40 is advanced across the skin with the front bar 31 located forwardly of the plucking head 40, as shown in FIGS. 7A to 7C. Thus, the vibrator i.e., the front bar 31 provides vibrations to the skin during or just before plucking the hair to stimulate Meissner's corpuscle or Pacinian corpuscle to activate the gate control path for alleviating the pain. The vibration is set to have an optimum amplitude and frequency which are determined respectively by the engaging amount of the cam projection 39 and the toothed wheel 69 and by the tooth pitch of the toothed wheel 69. In order to reduce mechanical friction between the cam projection 39 and the wheel 69, at least one of these members is made as a freely rotating member. As shown in FIGS. 7A to 7C, comb fins 142 are formed on the carrier 41 between the guide roller 141 and the pinching blades 44-1 and 44-2 along the

circumference of the plucking head 40 so as to guide the hairs smoothly in between the blades.

It should be noted here that each of the bearing projection 35 on opposite end of the skin guide frame 30 is shaped to have a curved upper surface 38 which is urged against an inner curved surface 25 of an end flange 22 of the head frame 20, as best shown in FIG. 8, by the action of the coil spring 100. The curved upper surface 38 of the bearing projection 35 has a radius of curvature R_2 which is less than a radius of curvature R_1 of the inner curved surface 25 of the head frame 20 so that the bearing projection 35 is engaged with the inner curved surface 25 of the head frame only at a point of contact P which moves along the inner curved surface 25 as the front bar 31 is depressed. That is, when no depression force acts on the front bar 31, as shown in FIG. 5, the guide frame 30 is kept in a neutral position as being urged upwardly together with the plucking head 40 by the coil spring 100 where the point of contact P lies on a vertical plane passing through the axis of the pins 36 as well as the shaft 42 and through a portion at which the guide frame 30 receives the upward bias through the plucking head 40, leaving a distance B_1 between the front bar 31 and the point of contact P (although not seen in FIG. 5). As a depression force F is applied to the front bar 31 as a result of the that front bar 31 is pressed against the skin, as shown in FIG. 8, the point of contact P moves away by a distance of H from the vertical plane. Consequently, the guide frame 30 is allowed to swing about thus moved point of contact P relative to the head frame 20 with increased distance B_2 between the front bar 31 and the point of contact P, which accompanies a corresponding depressive movement of the plucking head 40. That is, as the front bar 31 is depressed, it swings about the moving point of contact P defining a swing axis parallel to the shaft 42 of the plucking head 40 with attendant depressive movement of the plucking head 40. With such combination of the swinging and depression movements, the front bar, i.e., vibrator 31 can be kept in an optimum contact with the skin for alleviation of the pain. It is noted in this connection that the pins 36 on the opposite ends of the guide frame 30 are loosely and slidably engaged with the grooves 24 in the head frame 20 to allow the above combination movement of the guide frame 30.

FIGS. 9 and 10 illustrate a modified guide frame 30A which is identical to the above guide frame 30 except for a restrictor provided forwardly of the front bar, i.e., vibrator 31 to restrict the effect of the vibrations to be transmitted to the skin. Like parts are designated by like numerals with a suffix letter of "A". The restrictor comprises an elongate plate 150 mounted centrally on a jaw 151 which extends integrally from the end supports 34A. The plate 150 projects on the jaw 151 to abut against the skin forwardly of the vibrator 31A in the moving direction of the plucking head 40A, thereby restricting the extent at which the vibrator 31 applies the mechanical stimuli to the skin, i.e., the amplitude of the vibrations applied to the skin. Particularly with the pres-

ence of the restrictor **150**, it is readily possible to prevent the vibrator **31A** from being over-pressed against the skin which would otherwise reduce the vibration amplitude to an ineffective level or even stop the vibration. The restrictor **150** are connected to the jaw **151** through adjusting screws **153** which vary the projection amount of the restrictor **150** for obtaining an optimum effect of the restrictor.

FIGS. 11 and 12 illustrate further modified skin guide frames which are similar to the above guide frame but have different kinds of projections for transmitting the mechanical stimuli to the skin. The modified skin guide **30B** of FIG. 11 is formed on the front bar **31B** as well as on the end bars **33B** with bristles **130B**, while the skin guide frame of FIG. 12 is formed on the front bar **31C** with studs **130C**. Like parts are designated by like numerals with suffix letters "B" and "C", respectively in FIGS. 11 and 12.

FIG. 13 illustrate a still further modified skin guide frame **30D** which is similar to the above guide frame **30** except that a detachable applicator **155** is provided on the front bar **31D**. Like parts are designated by like numerals with a suffix letter of "D". The applicator **155** has a pair of hooks **156** which are detachably engageable into corresponding notches **158** in the bottom of a recess **157** formed in the upper surface of the front bar **31D**. When assembled, the applicator **155** is received in the recess **157** to apply the vibrations to the skin. With the use of a variety of detachably applicators of different stimulus transmitting configurations, the user can select one of the applicators on her preference.

Second Embodiment (FIGS. 14 to 16)

Referring to FIGS. 14 to 16, there is shown a second embodiment of the present invention which is identical to the first embodiment except that skin guide frame **30E** includes a vibrator **31E** which gives lateral vibrations in addition to the above vibrations acting in a direction generally perpendicular to the skin surface. Like parts are designated by like numerals with a suffix letter of "E". The opposite end bars **33E** of the guide frame **30E** which are connected only at their rear ends to the end support **34E** permit the front bar or vibrator **31E** move horizontally in the lengthwise direction of the front bar **31E** in addition to the vertical direction. Projecting inwardly from the center of the front bar **31E** is a follower pin **170** which is engaged into a spiral track **171** defined between a pair of guide rails **172** formed on the carrier **41E** at a portion circumferentially spaced from the fixed pinching blades **43E**. As the carrier **41E** or the plucking head **40E** swings about the axis of the shaft **42E**, the follower pin **170** is guided along the spiral track **171** to vibrate the front bar **31E** also in the lengthwise direction thereof, thereby applying the lateral vibrations to the skin simultaneously with the afore-mentioned vibrations for further enhancing the effect of applying the mechanical stimuli to the skin. It is noted in this respect that the lateral vibration thus given is selected to

have a small vibration amplitude which do not bring about any unpleasant skin rubbing.

Third Embodiment (FIGS. 17 to 21)

A depilating device in accordance with a third embodiment is identical in structure and operation to the first embodiment except that a vibration roller **160** with stimulus projections is mounted on a like skin guide frame **30F**. Like parts are designated by like numerals with a suffix letter of "F". The vibration roller **160** comprises a rotation shaft **162** carrying a plurality of bristles **161** extending radially therefrom over a length of the shaft and an eccentric weight **163** at one axial end of the shaft **162**. The rotation shaft **162** is supported by bearings in the skin guide frame **30F** and is driven by an incorporated motor **70F** so that the vibration roller **160** rotates about the axis of the shaft **162** in parallel with a swing axis about which the plucking head **40F** oscillates for plucking the hairs in the same manner as explained in the first embodiment. Due to the provision of the eccentric weight **163**, the mass center of the whole roller **160** is displaced from the rotation axis of the shaft **162** so that the roller **160** will vibrate as it is driven to rotate, thereby giving mechanical vibratory motion with which the bristles **161** can apply the mechanical stimuli to the skin. Instead of using the eccentric weight **163**, the bristles or the like stimulus projections are arranged around the shaft **162** unevenly to give an offset center of mass displaced from the rotation axis of the shaft **162**.

The skin guide frame **30F** is held on the plucking head **40F** which is floatingly supported to a housing **10F** by means of a coil spring **100F** so that the guide frame **30F** is capable of being depressed together with the plucking head **40F** against the bias of the coil spring **100F**. The floatingly support mechanism permits the skin guide frame itself to vibrate relative to the head frame as the roller **160** is driven to rotate, thereby applying the resulting vibrations to the skin. Further, the guide frame **30F** is made to swing relative to the plucking head **40F** in the same manner as in the first embodiment, i.e., swing with attendant depression of the plucking head **40F**, as a result of a front end bar **31F** being pressed against the skin. Alternately, the guide frame may be made to swing independently of the depression movement of the plucking head.

The vibration roller **160** is mounted between the front bar **31F** and the plucking head **40F** with its rotation axle **162** supported in corresponding bearing slots in the guide frame **30F**, as shown in FIG. 18. The front bar **31F** is formed with fins **135** which act to stretch the skin prior to plucking the hairs therefrom, as shown in FIG. 21. A smooth roller **131F** is held on a rear bar **32F** of the frame **30F** for rolling contact with the skin to guide the plucking head smoothly on the skin.

As shown in FIGS. 17 and 20, the vibration roller **160** is drivingly connected to a positive-return cam **80F** through an upper link **254** and a lower link **255** so that it is driven to rotate by the incorporated motor **70F** which

drives the positive-return cam. That is, the vibration roller 160 has one axial end connected through a universal joint 253 to the upper link 254 of which lower end is detachably and slidably engaged into a socket 256 of the lower link 255 to allow the vibration roller 160 to move relative to the head frame. The lower end of the lower link 255 is then connected through another universal joint 257 to a drive pin 258 projecting from the axial end of the positive-return cam 80F. The roller 160 thus connected to the motor is driven thereby to rotate in a direction, as indicated by an arrow X in FIGS. 20 and 21, which opposes the advancing direction Y of the plucking head 40F as well as a direction Z in which the plucking head 40F swings for plucking the hair from the skin. Since the roller 160 is driven to rotate while manipulating the plucking head to advance over the skin, the bristles 161 of the roller 160 can intermittently apply the mechanical stimuli to skin from which the hairs are just being plucked, thereby alleviating the hair plucking pain. The above relation between the directions X, Y, and Z of the roller 160 and the plucking head 40F are found to be effective for alleviating the pain. Particularly, in addition to applying the vibratory mechanical vibrations, the roller 160 rotating in the direction X acts to successfully raise the hairs lying on the skin or curled hairs so that the pinching blades 44-1F and 44-2F can catch the root of the hairs and pluck the hair in the direction of its growth with a reduced pain.

Although not disclosed in the figures, the skin guide frame 30F of this embodiment may be formed to have a movable front bar as seen in the previous embodiments and the vibration roller 160 may be supported to be movable together with the movable front bar for a limited extent relative to the other portion of the skin guide frame.

Fourth Embodiment (FIGS. 22 to 28)

A depilator device in accordance with a fourth embodiment of the present invention is similar in structure and in operation to the first embodiment except that at least one roller is mounted adjacent to a like plucking head to apply the mechanical stimuli to the skin as it is caused to rotate by contact with the skin. Like parts are designated by like numerals with like numerals with a suffix letter of "G". The roller 180 is disposed in generally parallel with and immediately behind a front bar 31G of a like skin guide frame 30G to be freely rotatable about an axis of a shaft 182 the opposite ends of which are supported to bearing slots 183 in the opposite ends of the front bar 31G. The roller 180 carries a plurality of radially projecting bristles 181 arranged circumferentially and axially over a corresponding length of the plucking head 40G. A pair of additional rollers 190 are mounted respectively on the guide frame 30G axially outwardly of the plucking head 40G. Each of the additional rollers 190 is also supported to be freely rotatable about an axis of a shaft 192 and carries a plurality of radially projecting bristles 191. These rollers 180 and

190 are made into rolling contact with the skin and caused to rotate as the plucking head 40G is manipulated to move across the skin, during which the bristles 181 and 191 apply the mechanical stimuli to the skin for alleviating the pain of plucking the hairs.

The skin guide frame 30G is made of a plastic material into a unitary structure of a generally rectangular configuration composed of the front bar 31G, rear bar 32G, and opposed end support 34G integrally connecting the front and rear bars. The front bar 31G is connected to the end supports 34G at its opposite ends respectively through resilient members 33G so that the front bar 31G is allowed to move vertically within a limited extent relative to the other portion of the guide frame 30G. The end support 34G is provided with a recess 194 for receiving the additional roller 190. The roller 180 supported by the front bar 31G is allowed to be depressed together with the front bar 31G relative to the other portion of the guide frame 30G for a limited extent after which it is depressed together with the guide frame 30G and the plucking head 40G relative to the head frame 20G. In this manner, the roller 180 is made to easily follow the skin configuration. The front bar 31G is formed with comb projections 130G for smoothing and raising the hairs prior to plucking the same. It is noted here that the plucking head 40G is floatingly supported by the same spring mechanism as utilized in the first embodiment so as to be depressed relative to the head frame 20G and that the skin guide frame 30G is held on the plucking head 40G to receive the upward bias from the spring mechanism so as to be depressed together with the plucking head 40G.

The rear bar 32G carries a freely rotatable smooth roller 131G which comes into rolling contact with the skin behind the plucking head 40G for smoothly guiding the plucking head in the moving direction. FIGS. 27A to 27C illustrate the sequence of the plucking operation in which the plucking head 40G moves from left to right in the figures while swinging about the longitudinal axis thereof as indicated by arrows for plucking the hairs. During this operation, the roller 180 and the additional rollers 190 (although not seen in these figures) are kept in rolling contact with the skin so that the bristles 181 and 191 thereof can apply the mechanical stimuli to the skin for masking the pain of plucking the hairs.

Also in this embodiment, the guide frame 30G is formed on opposite ends thereof with like bearing projections 35G which include individual pins 36G for loose engagement into corresponding vertical grooves 24 in the opposite inner end surface of the head frame 20G. Further, the bearing projections 35G are formed in their lower ends with recesses 37G into which an upper end 62G of a like chassis 60G carrying the plucking head 40G engages so that the guide frame 30G is floatingly supported and is capable of being depressed together with the plucking head 40G. Each of the bearing projections 35G has a curved upper surface 38G which is urged against an inner curved surface 25G of an end flange 22G of the head frame 20G, as best shown in

FIG. 26A, by the bias of a coil spring (not shown) acting to urge the plucking head **40G**. The curved upper surface **38G** of the bearing projection **35G** has a radius of curvature R_2 which is less than a radius of curvature R_1 of the inner curved surface **25G** of the head frame **20G** so that the bearing projection **35G** is engaged with the inner curved surface **25G** of the head frame only at a point of contact P which moves along the inner curved surface **25G** as the front bar **31G** is depressed. That is, when no depression force acts on the front bar **31G** as shown in FIG. 26A, the guide frame **30G** is kept in a neutral position as being urged upwardly together with the plucking head **40** where the point of contact P lies on a vertical plane passing through the axis of the pin **36G** and through the point at which the guide frame **30G** receives the upward bias from the plucking head **40G**, leaving a distance B_1 between the front bar **31G** pressed against the skin and the point of contact P. As a depression force F is applied to the front bar **31G** as a result of being pressed against the skin, as shown in FIG. 26B, the point of contact P moves away by a distance of H from the vertical plane. With this consequence, the guide frame **30G** is allowed to swing about thus moved point of contact P relative to the head frame **20G** with increased distance B_2 between the front bar **31G** and the point of contact P, which accompanies a corresponding depressive movement of the plucking head **40G**. That is, as the front bar **31G** is depressed together with the roller **180**, the guide frame **30G** swings about the moving point of contact P with attendant depressive movement of the plucking head **40G**. With such combination of the swinging and depression movements, the front bar **31G** and the roller **180** can be kept in an optimum contact with the skin for alleviation of the pain. It is noted in this connection that the pins **36G** on the opposite ends of the guide frame **30G** are loosely and slidably engaged with the grooves **24G** in the head frame **20G** to allow the above combination movement of the guide frame **30G**.

The rollers **180** and **190** are preferred to be detachably mounted to the guide frame **30G** so that the user can select optimum rollers from a set of rollers of providing different stimuli on her preference. FIG. 24 illustrates one scheme for the detachable mounting of the rollers **190**, although it is equally applicable for the roller **180**. The roller **190** is received in the recess **194** with its shaft **192** retained in bearing slots **193**. The bearing slot **193** is formed in its upper end with latches **195** which project inwardly to define an entrance of a width slightly narrower than the diameter of the shaft **192**. Due to resilient deformability inherently given to the plastic-made guide frame **30G**, the shaft **192** is allowed to pass through the entrance and is locked in the bearing slot **193** behind the latches **195** for easy attachment of the roller **190**. Likewise, the detachment of the roller can be made easily by the use of the resilient deformability. Although not shown in the figure, it is possible to make the bearing slots **193** deep enough and to provide additional latches intermediate its depth to latch the shaft **192** in the slots

at different depth. With this design, it is made easy to adjust the projection amount of the roller or the bristles on the guide frame for selecting strong or weak mechanical stimuli from the rollers.

Although the rollers with the bristles are shown in the above, the present invention is not limited thereto and may include rollers of different configurations as explained below. A roller **200** in accordance with a first modification is shown in FIGS. 29A and 29B and comprises a plurality of elastic fins **201** spaced circumferentially and axially of the roller. The fin is made thinner toward its tip than at the root to be given elastic deformability for enhanced skin contact effect.

FIGS. 30A and 30B show a second modification of roller **210** with a combination of bristles **211** and elastic projections **212** which project radially with different radial lengths to define stimulus projections of applying different stimuli to the skin. The bristles **211** and the elastic projections **212** alternate in the circumferential direction and arranged along the axial length of the roller. The elastic projection may be a bundle of the bristles. With the use of the stimulus projections of different characteristics, it is possible to apply different kinds of mechanical stimuli to the skin for enhancing the alleviation of the hair plucking pain.

FIGS. 31A and 31B show a third modification of roller **220** with another combination of bristles **221** and elastic fins **222** which alternate in the circumferential direction. The elastic fins **222** is continuous over the substantial axial length of the roller **220** to apply the mechanical stimulus different from the bristles to the skin as it rotates on the skin.

FIGS. 32A and 32B show a fourth modification of roller **230** with a further combination of bristles **231** and rings **232** which alternate in the axial direction of the roller and apply different mechanical stimuli to the skin, respectively.

FIG. 33 shows a fifth modification of roller **240** with elastic fins **241** which are spaced circumferentially and axially of the roller with the width thereof aligned in the axial direction.

The features disclosed in the foregoing description, in the claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

LIST OF REFERENCE NUMERALS

10	housing
13	power switch
14	terminal pins
15	hook
16	stand
18	base plate
20	head frame
21	end wall
22	end flange
23	opening

24 groove
 25 curved inner surface
 30 skin guide frame
 31 front bar
 32 rear bar
 33 end bar
 34 end support
 35 bearing projection
 36 pin
 37 recess
 38 curved surface
 39 cam projection
 34 wing stretcher
 35 front stretcher
 37 roller
 38 positioning limb
 39 resilient flap
 40 plucking head
 41 carrier
 42 shaft
 43 fixed pinching plate
 44-1 movable pinching plate
 44-2 movable pinching plate
 45 hole
 46 anchor leg
 47 side tab
 48 groove
 49 gear
 50-1 slider
 50-2 slider
 52 axle
 53 furrow
 60 chassis
 61 top plate
 62 shoulder
 63 flange
 64 eccentric pin
 65 crank lever
 66 rack wheel
 68 shaft
 69 boss
 70 motor
 71 pinion
 72 first gear
 74 second gear
 75 second shaft
 78 seal ring
 80 positive-return cam
 81 groove
 82 bearing
 83 second gear
 90 cam cylinder
 91 barrel
 95 pin
 97 cam follower
 100 coil spring
 130 comb projection
 131 roller
 132 shaft

135 fin
 141 roller
 142 comb fin
 150 restrictor (plate)
 5 151 jaw
 153 screw
 155 applicator
 156 hook
 157 recess
 10 158 notch
 160 vibration roller
 161 rotary shaft
 162 bristle
 163 eccentric weight
 15 170 follower pin
 171 spiral path
 172 guide
 180 roller
 181 bristle
 20 182 shaft
 183 bearing slot
 190 roller
 191 bristle
 192 shaft
 25 193 bearing slots
 194 recess
 195 latch
 200 roller
 201 elastic fin
 30 210 roller
 211 bristle
 212 elastic projection
 220 roller
 221 bristle
 35 222 elastic fin
 230 roller
 231 bristle
 232 ring
 240 roller
 40 241 elastic fin
 253 universal joint
 254 upper link
 255 lower link
 256 socket
 45 257 universal joint
 258 drive pin

Claims

- 50 1. A hand-held depilating device for plucking hairs from the skin of a user, said depilating device comprising:
- 55 a housing (10) adapted to be grasped by the hand of the user;
 a plucking head (40; 40A; 40E; 40F) mounted on top of said housing for plucking the hairs from the skin;
 stimulator means mounted on top of said hous-

ing adjacent to said plucking head for providing mechanical stimuli to the skin while said plucking head operates to pluck the hairs;

characterised in that said stimulator means comprises a vibrator (31; 31A; 31B; 31C; 31D,155; 31E; 160) which providing vibrations to said skin as said mechanical stimuli.

2. The hand-held depilating device as set forth in claim 1, wherein said vibrator comprises a vibration roller (160) which is rotatably supported to the top of said housing (10F) and is driven by an incorporated motor (70F) to rotate about a rotation axis eccentric from a mass center of the roller so that it vibrates to give said mechanical stimuli.
3. The hand-held depilating device as set forth in claim 1, wherein said vibrator (31; 31A; 31B; 31C; 31D,155; 31E; 160) vibrates in a direction perpendicular to a general surface of the skin.
4. The hand-held depilating device as set forth in claim 1, wherein said plucking head (40; 40A; 40E; 40F) is floatingly supported to said housing to be capable of being depressed and wherein said vibrator (31; 31A; 31B; 31C; 31D,155; 31E; 160) is carried on a skin guide frame (30; 30A; 30B; 30C; 30D; 30E; 30F) which is floatingly supported to said housing to be capable of being depressed together with said plucking head.
5. The hand-held depilating device as set forth in claim 4, wherein said skin guide frame (30; 30A; 30B; 30C; 30D; 30E) is supported to said housing so that it can swing about a swing axis while being depressed together with said plucking head.
6. The hand-held depilating device as set forth in claim 5, wherein said skin guide frame (30) is engaged at a point of contact (P) on a rounded portion (25) of said housing, said point of contact (P) defining said swing axis about which said skin guide frame can swing, said point of contact being caused to move along said rounded portion (25) as said skin guide frame swings with an attendant depression of said plucking head.
7. The hand-held depilating device as set forth in claim 1, wherein a restrictor (150) is provided adjacent to said vibrator (31A) for restricting an effect of vibration to be applied to the skin.
8. The hand-held depilating device as set forth in claim 7, wherein said restrictor (150) includes means (153) for variably adjusting said effect of vibration.
9. The hand-held depilating device as set forth in

claim 1, wherein said vibrator (31D) includes a skin contact member (155) which is detachable to said vibrator.

10. A hand-held depilating device for plucking hairs from the skin of a user, said depilating device comprising:

a housing (10G) adapted to be grasped by the hand of the user;
a plucking head (40G) mounted on top of said housing for plucking the hairs from the skin;
stimulator means mounted on top of said housing adjacent to said plucking head for providing mechanical stimuli to the skin while said plucking head operates to pluck the hairs;

characterised in that said stimulator means comprises a roller (180; 190; 200; 210; 220; 230; 240) with a plurality of stimulus projections (181; 191; 201; 211,212; 221,222; 231,232; 241), said roller being rotatably mounted to said housing for rolling contact with the skin as said depilating head is manipulated across the skin so that said stimulus projections provide said mechanical stimuli to the skin.

11. The hand-held depilating device as set forth in claim 10, wherein said stimulus projections are in the form of bristles (181; 191; 211; 221) projecting radially from said roller.
12. The hand-held depilating device as set forth in claim 10, wherein said plucking head (40G) is floatingly supported to said housing to be capable of being depressed and wherein said roller (180; 190; 200; 210; 220; 230; 240) is carried on a skin guide frame (30G) which is floatingly supported to said housing to be capable of being depressed together with said plucking head.
13. The hand-held depilating device as set forth in claim 10, wherein said roller (180; 190; 200; 210; 220; 230; 240) is carried on a skin guide frame (30G) which is pivotally supported to said housing to be swingable about a swing axis.
14. The hand-held depilating device as set forth in claim 10, wherein adjusting means (193;195) is provided to adjust a projection amount of said stimulus projections from the top of the housing.
15. The hand-held depilating device as set forth in claim 10, wherein said roller (190) is detachably mounted to said housing.
16. The hand-held depilating device as set forth in claim 10, wherein said plucking head (40G) is floatingly supported to said housing (10G) to be capable

of being depressed, a skin guide frame (30G) being provided to surround said plucking head and comprise a main body (34G) which is connected to said plucking head to be capable of being depressed together therewith and a front guide (31G) which is movably supported to said main body for limited displacement relative to said main body, and said roller (180; 190; 200; 210; 220; 230; 240) being supported to said front guide.

5

10

17. The hand-held depilating device as set forth in claim 16, wherein said skin guide frame (30G) is supported to said housing so that it can swing about a swing axis (P) while being depressed together with said plucking head.

15

18. The hand-held depilating device as set forth in claim 17, wherein said skin guide frame (30G) is engaged at a point of contact (P) on a rounded portion (25G) of said housing, said point of contact defining said swing axis about which said skin guide frame can swing, said point of contact being capable of moving along said rounded portion (25G) as said skin guide frame swings and depressed.

20

25

30

35

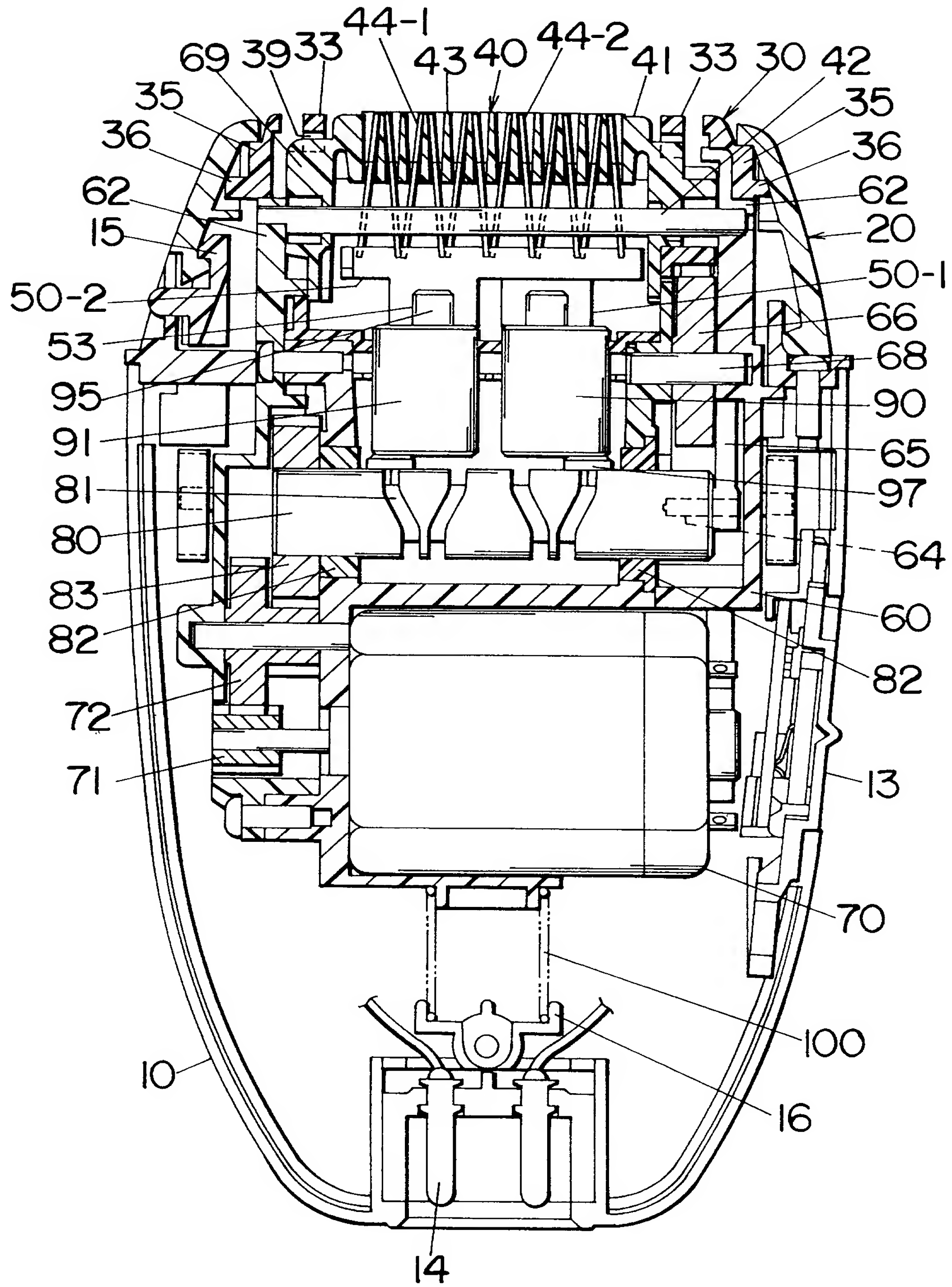
40

45

50

55

Fig. 1



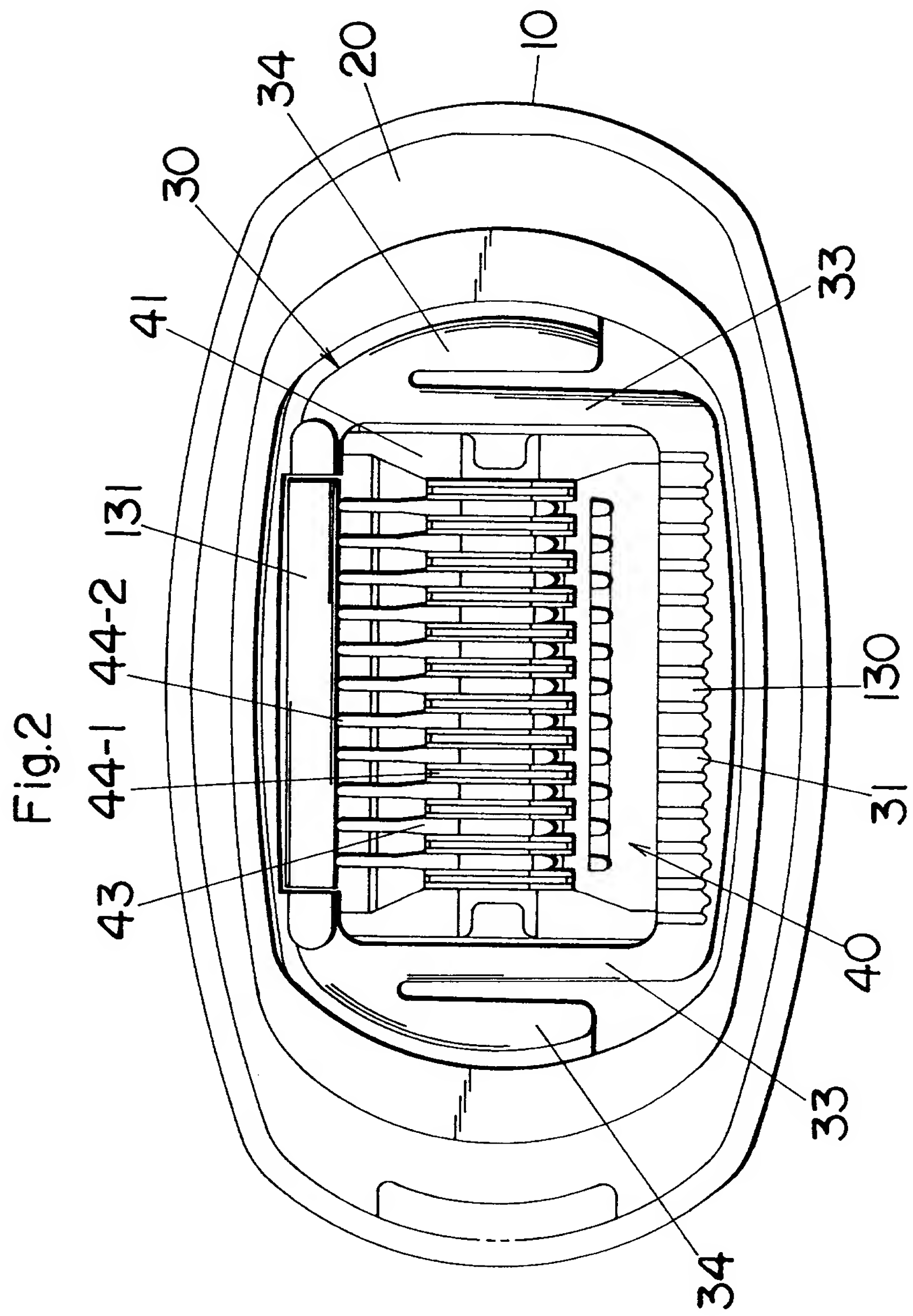


Fig.3

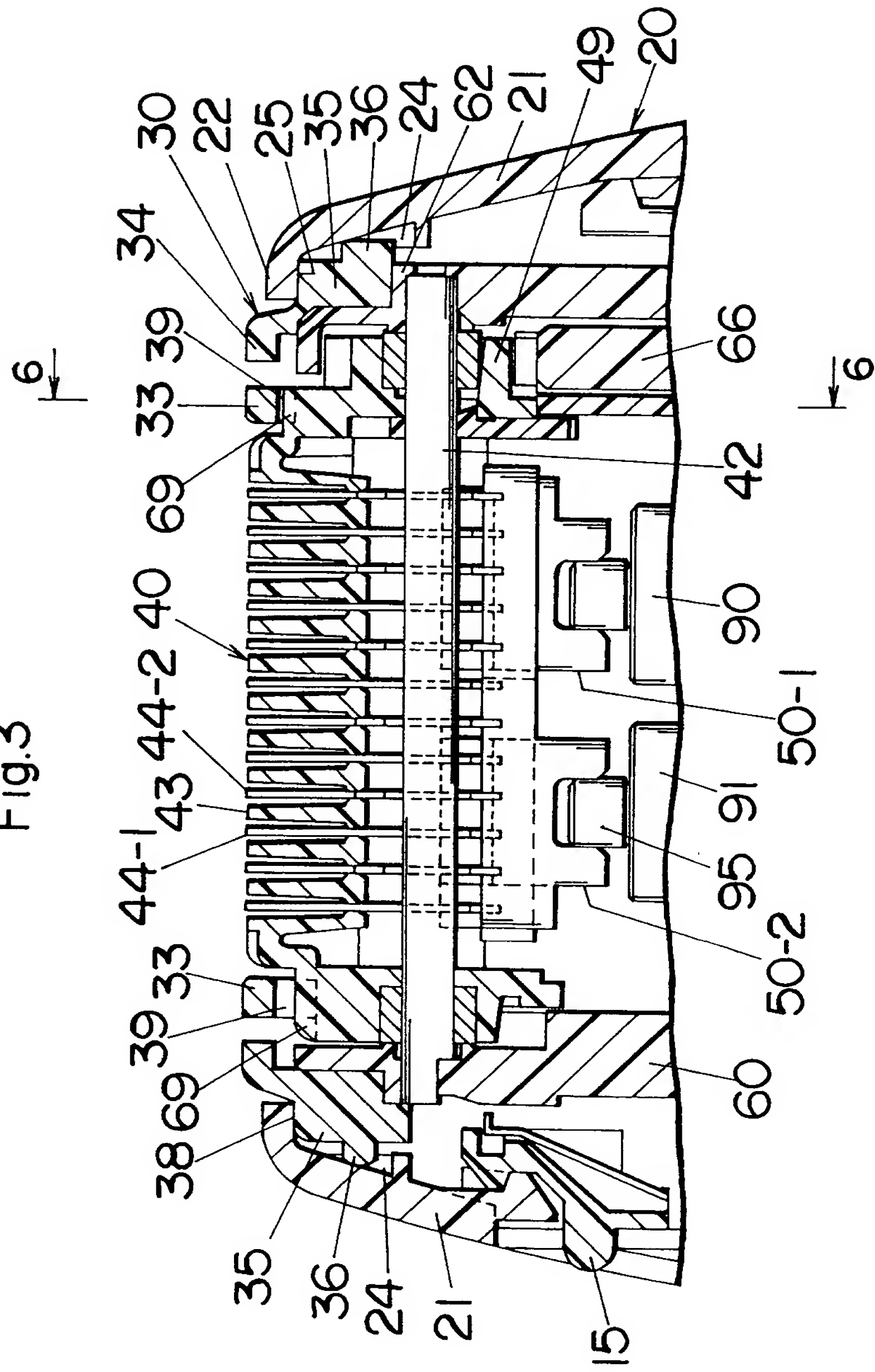


Fig.4

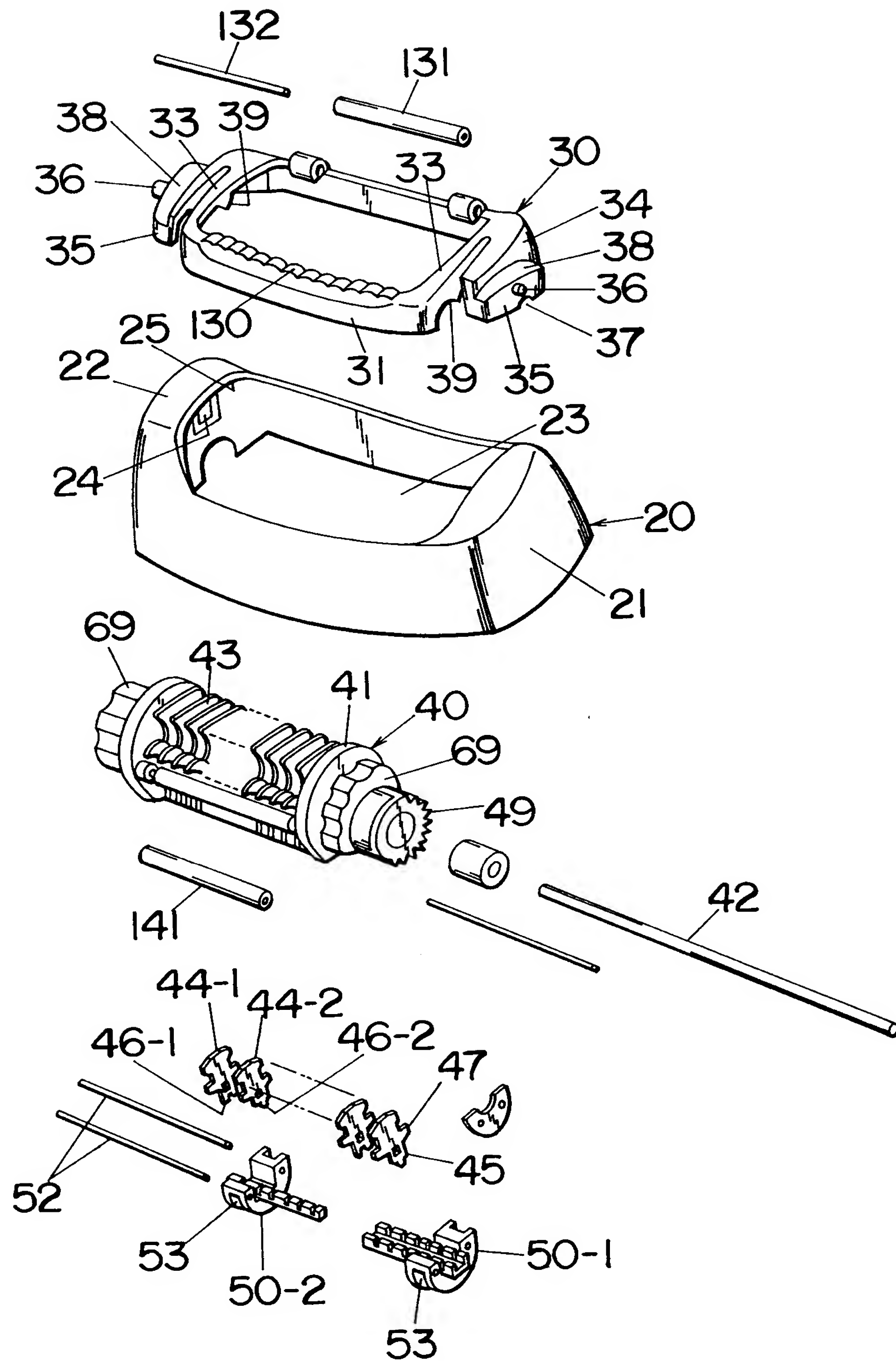


Fig.5

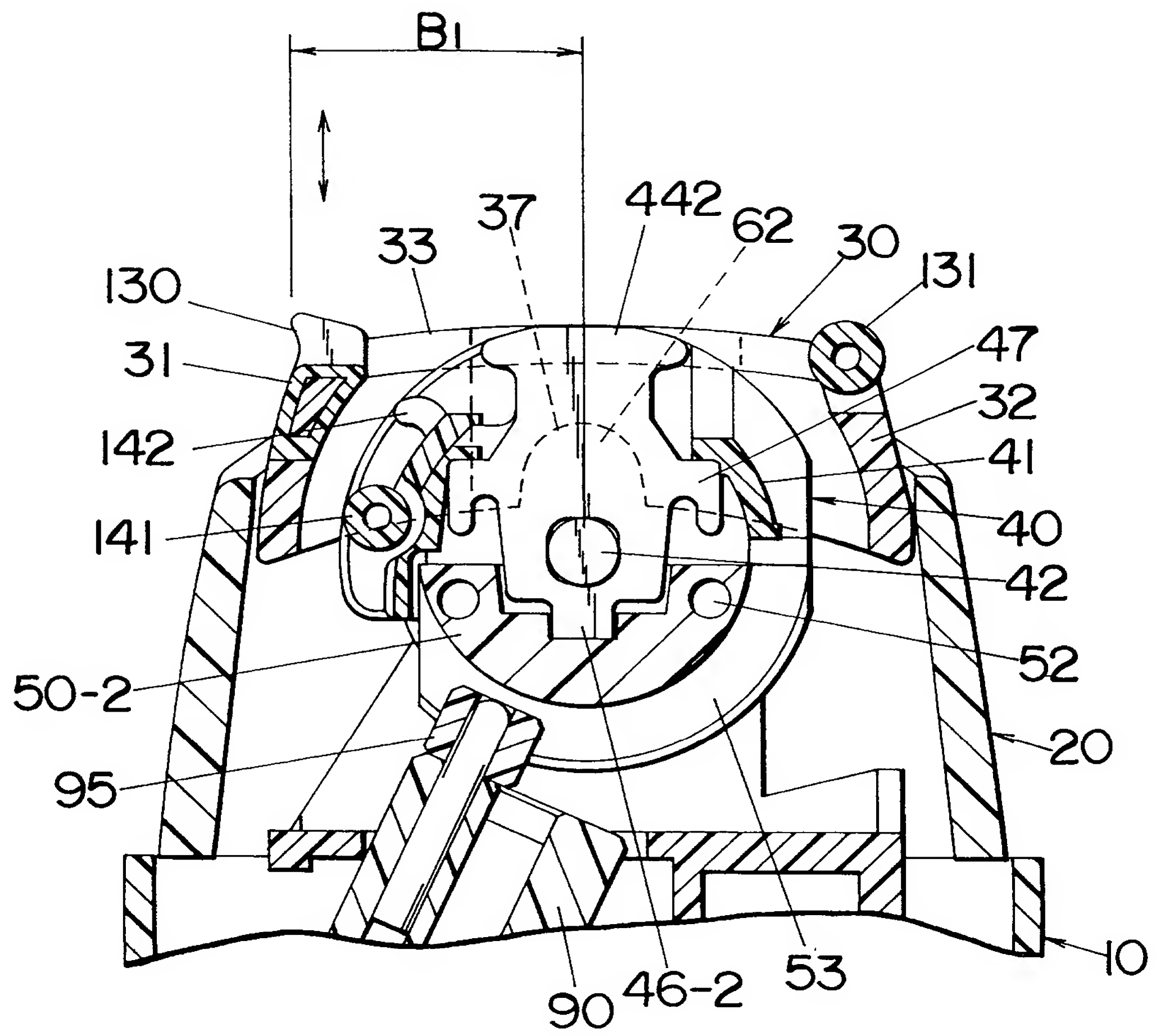


Fig.6A

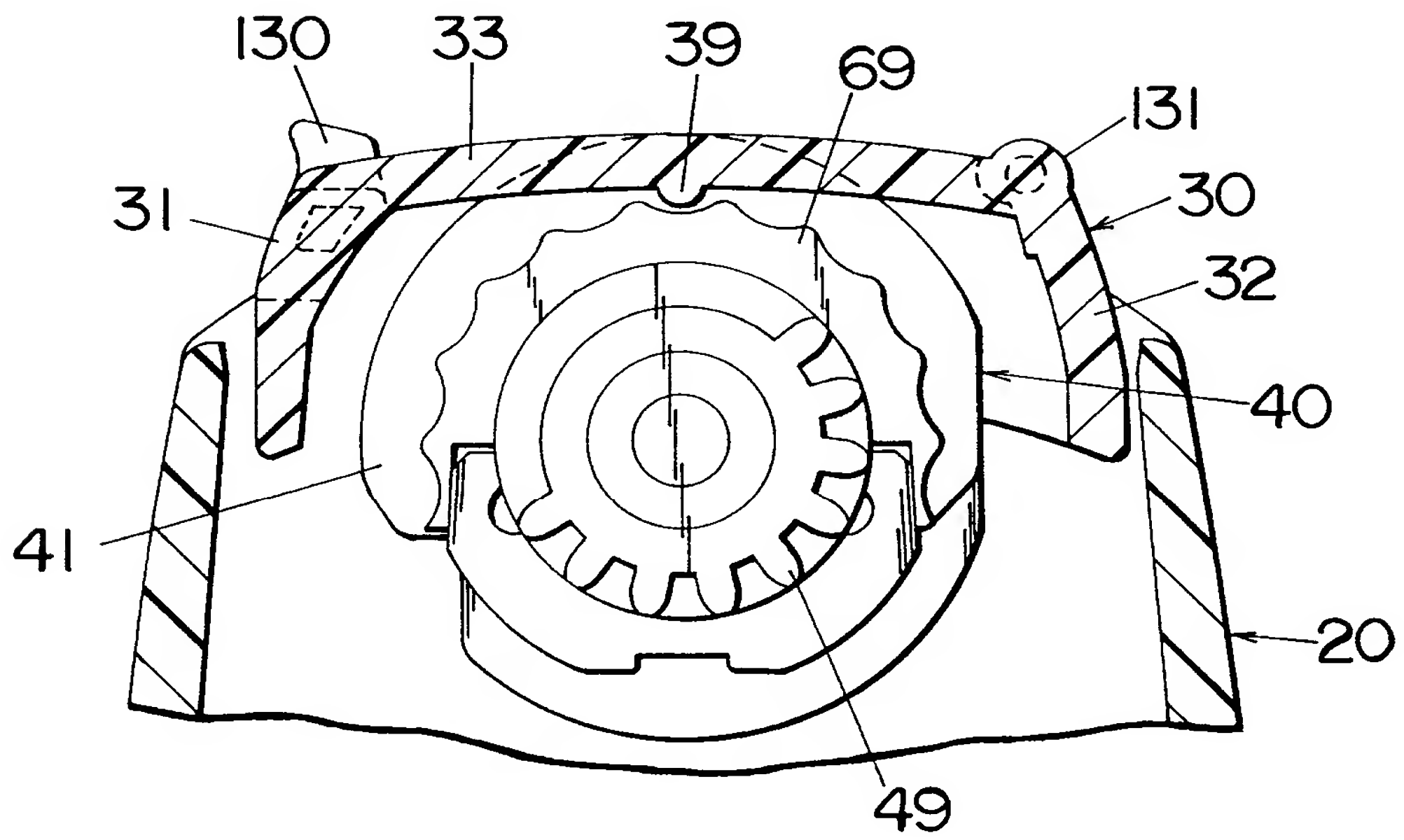


Fig.6B

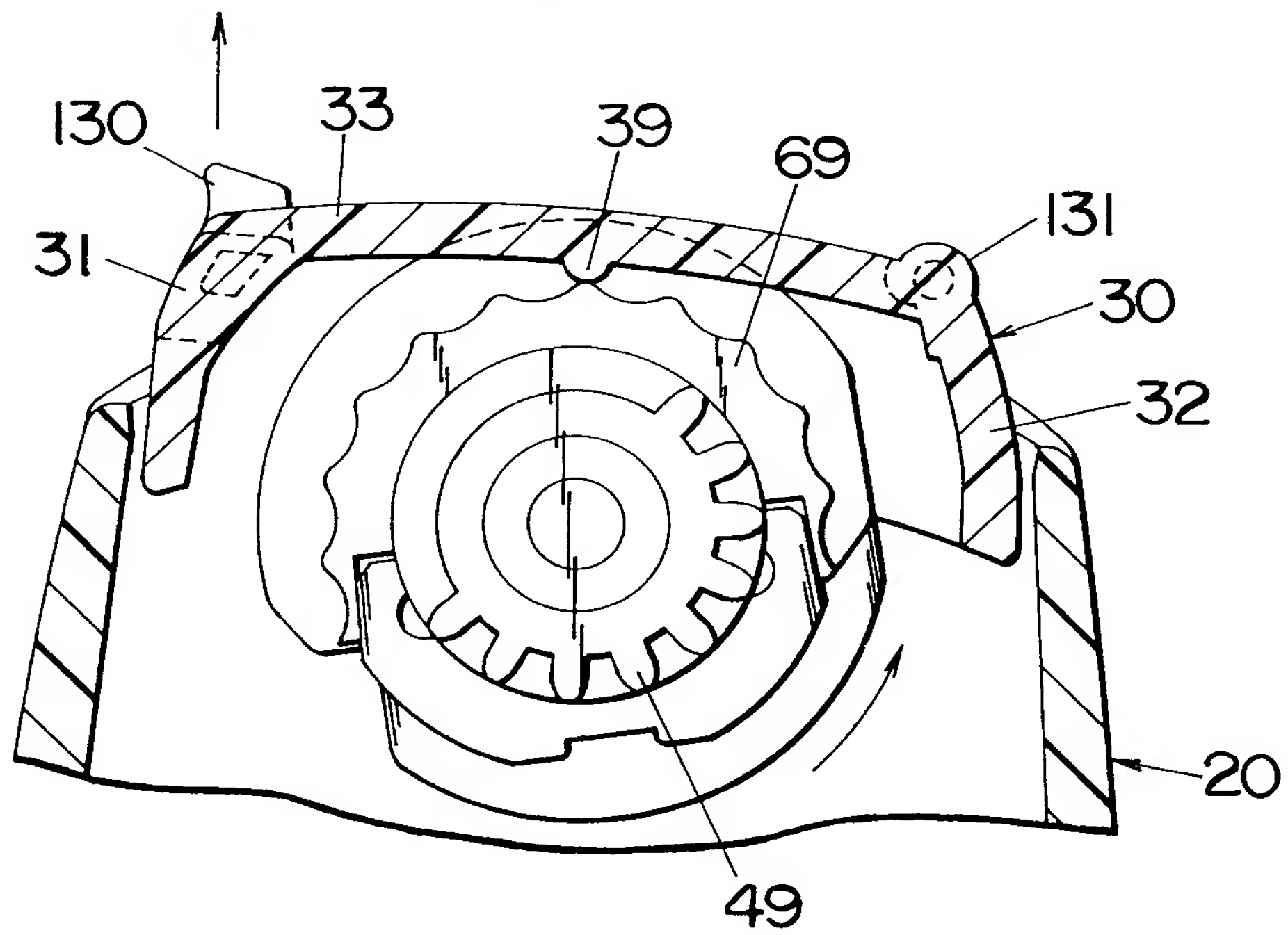


Fig.7A

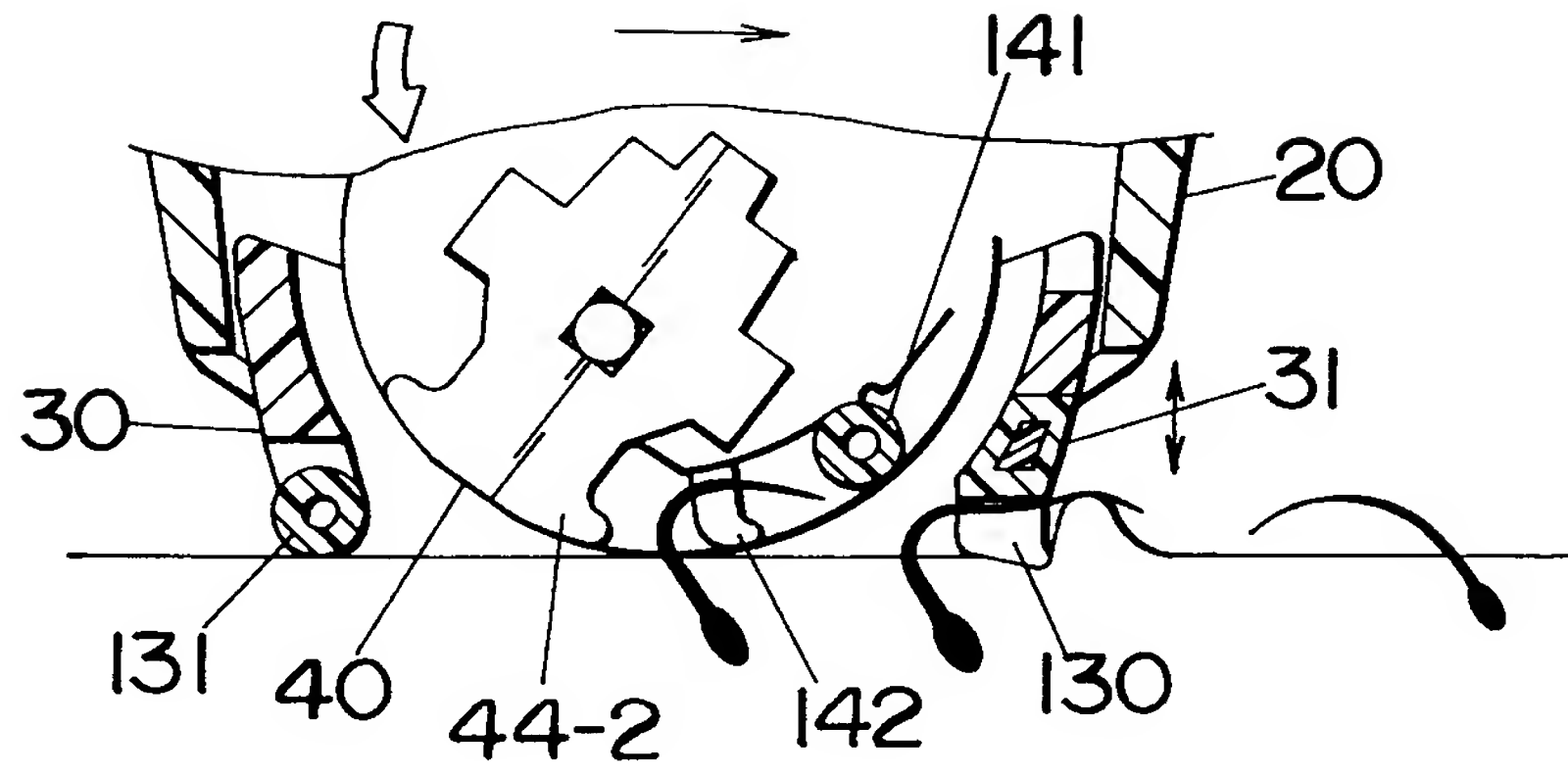


Fig.7B

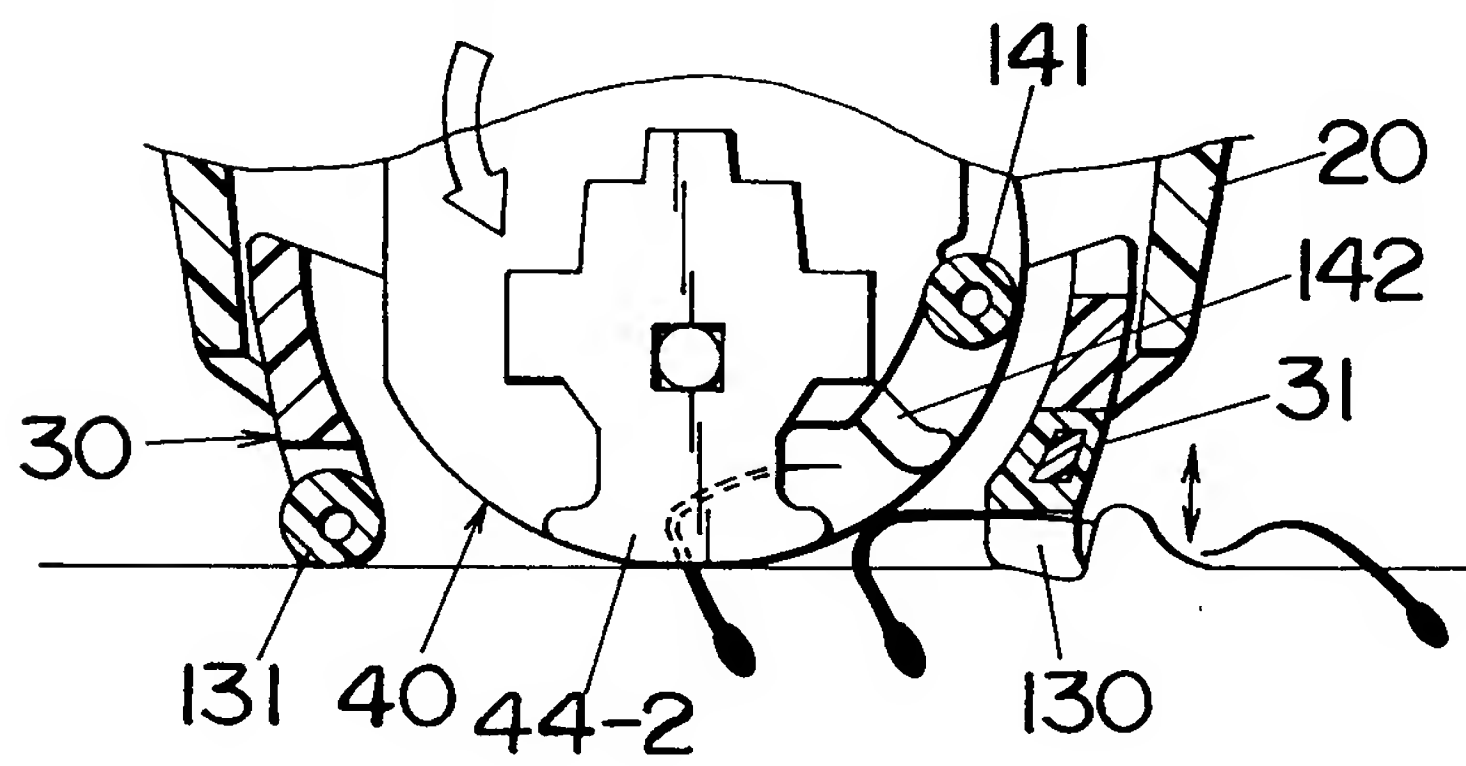


Fig.7C

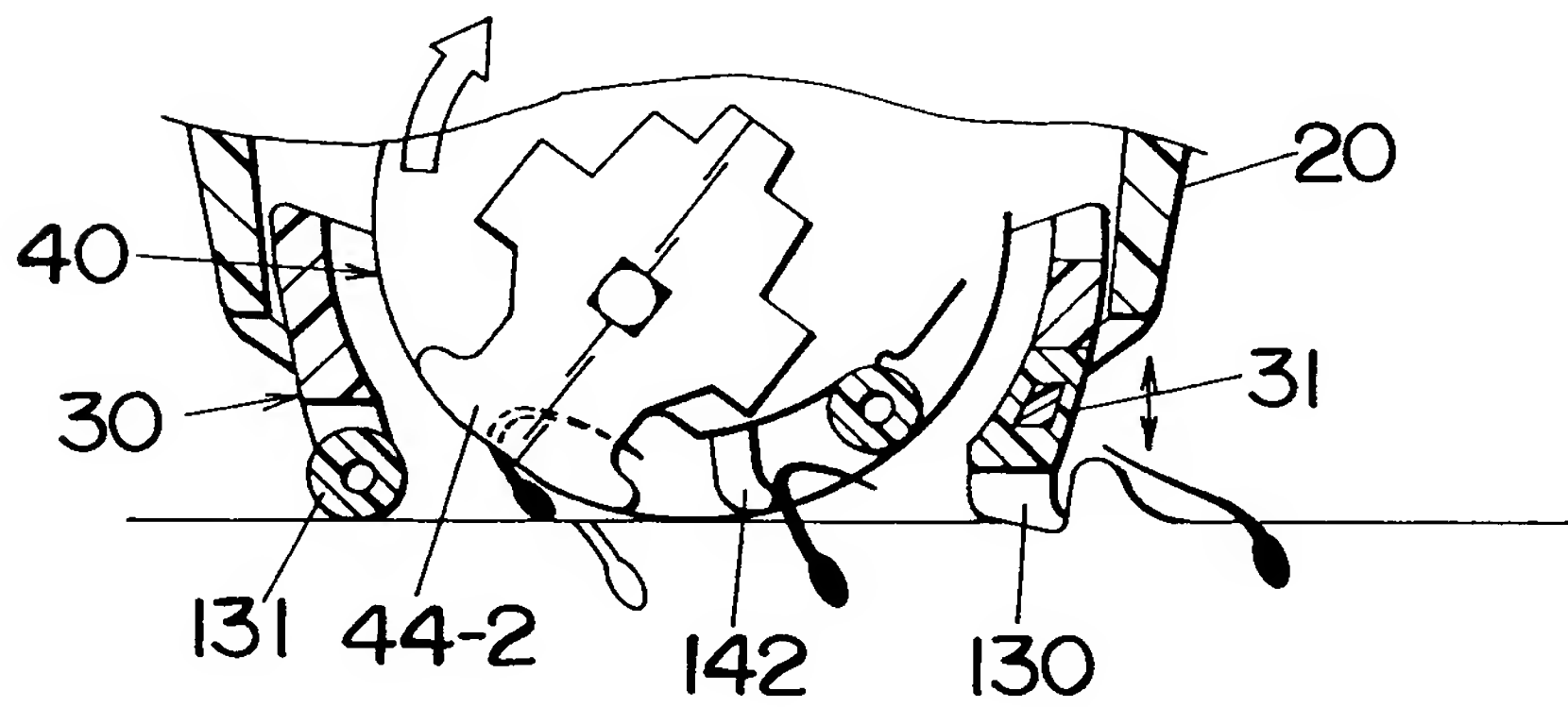


Fig.8

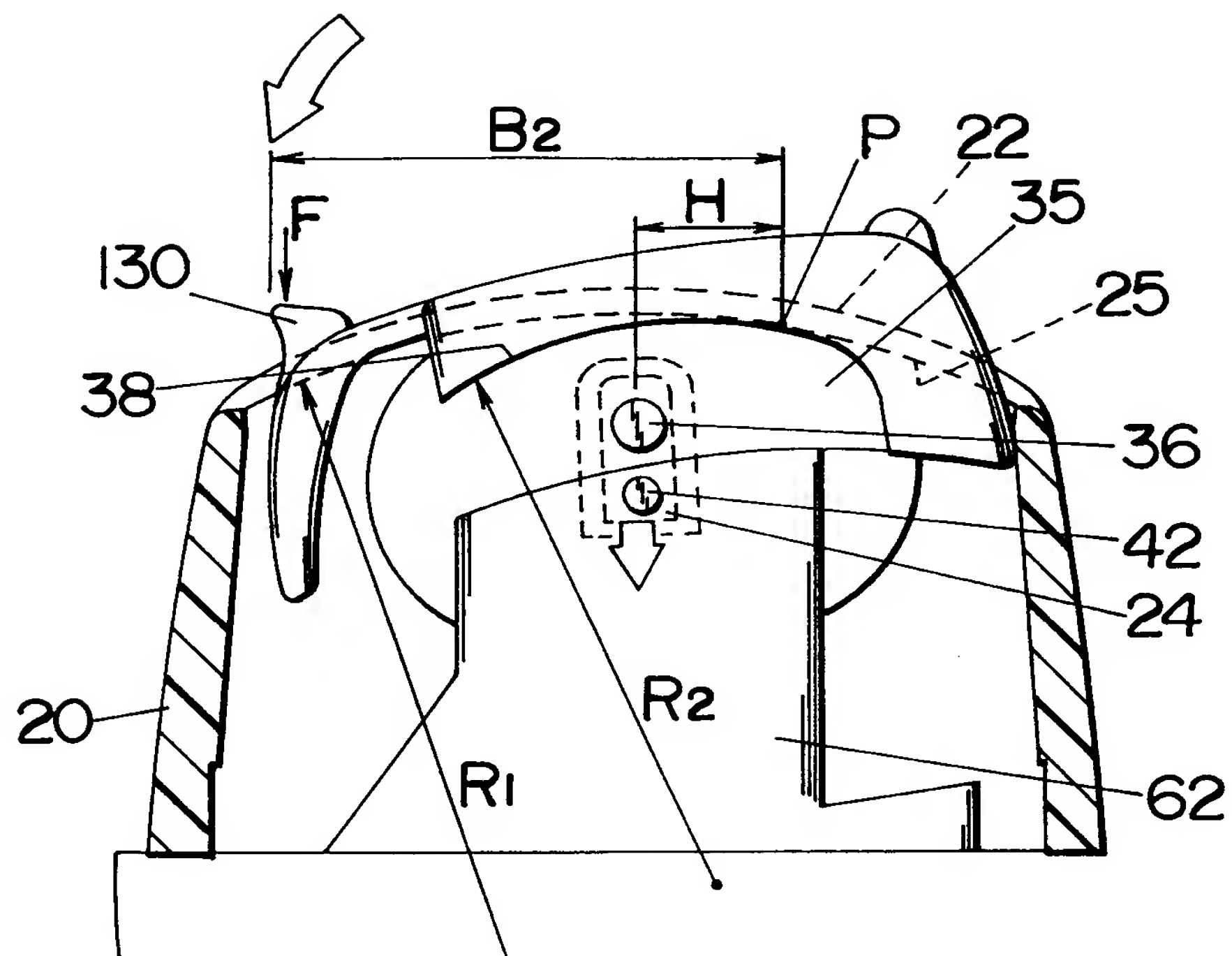


Fig.9

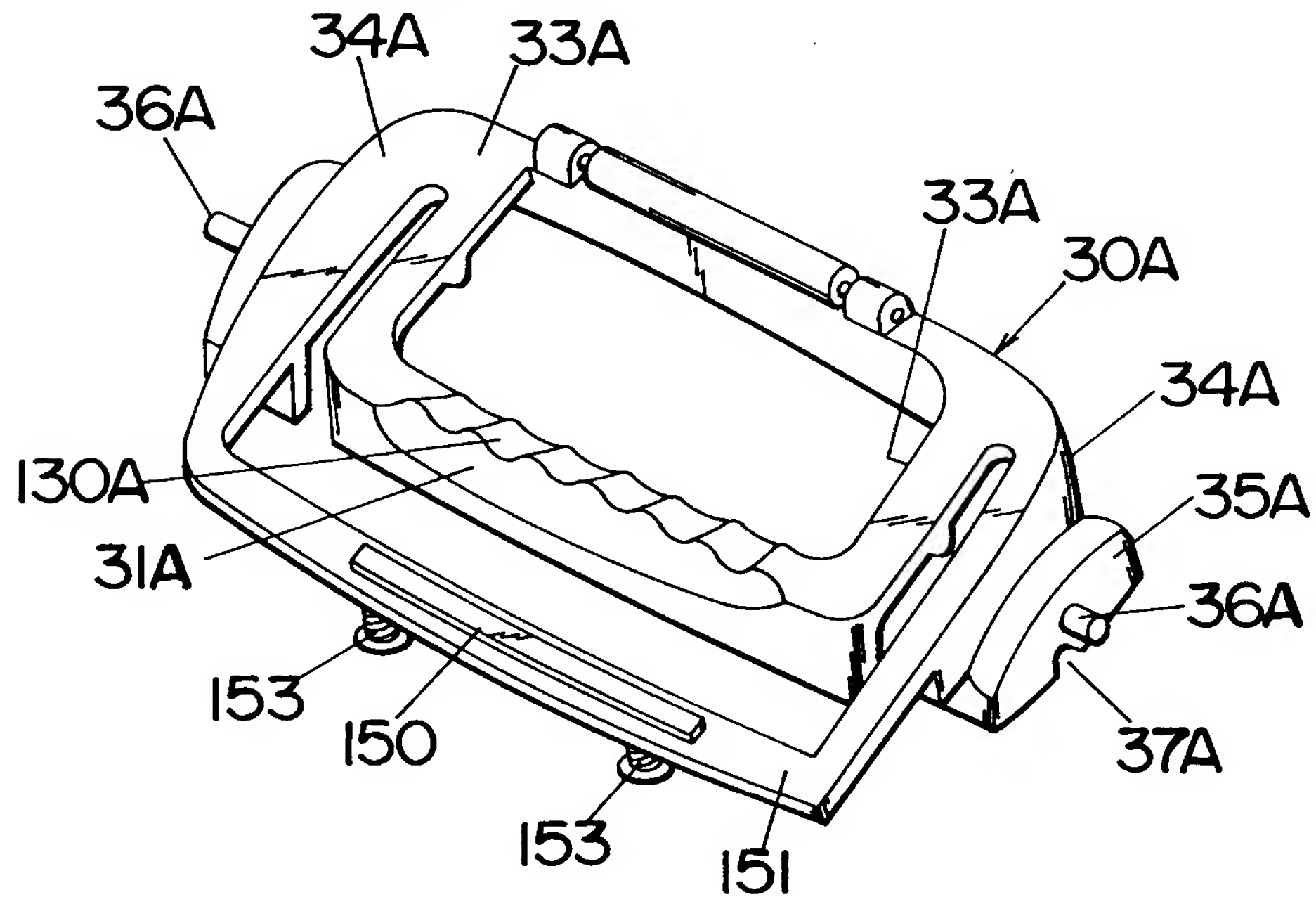
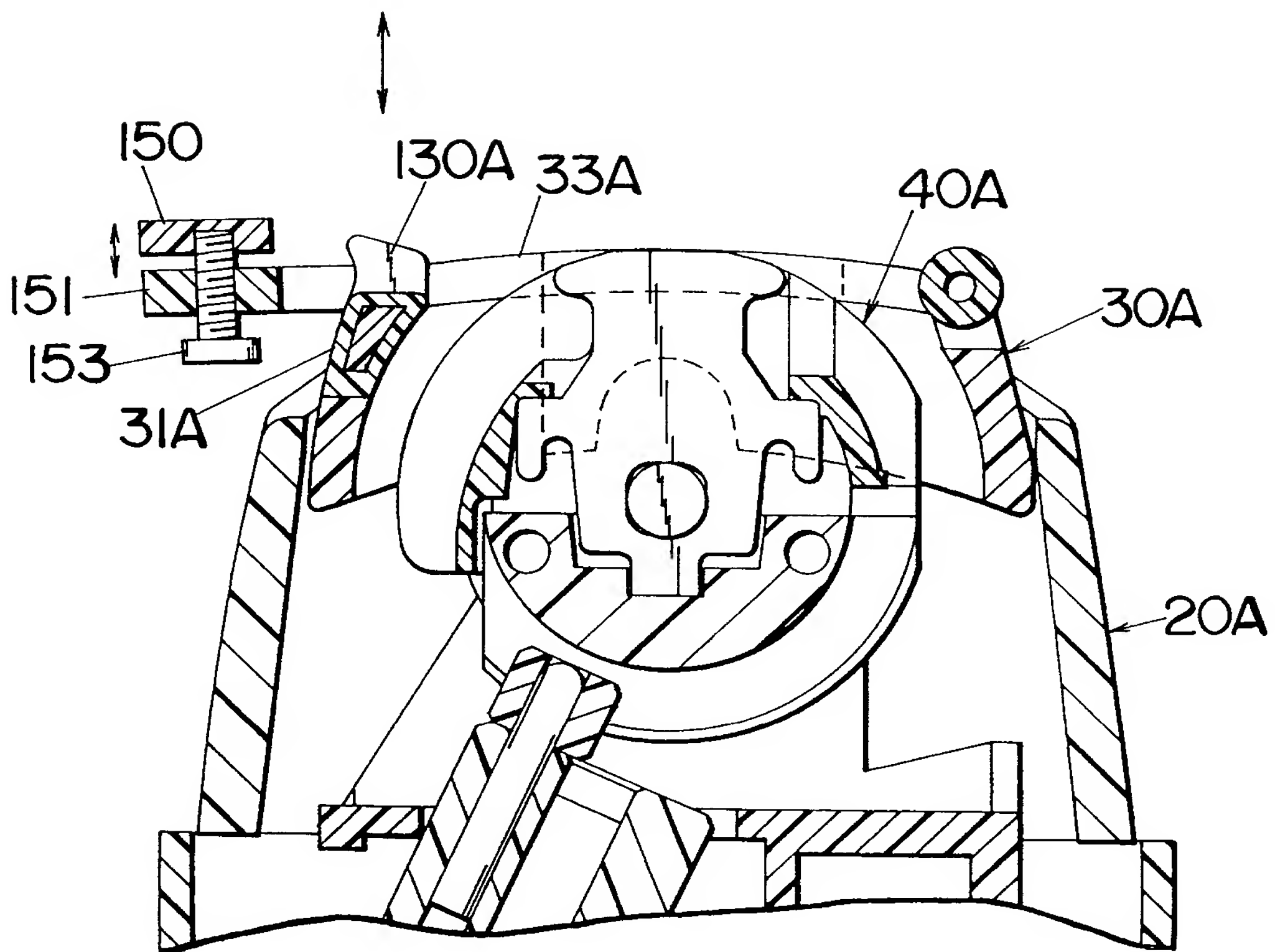


Fig.10



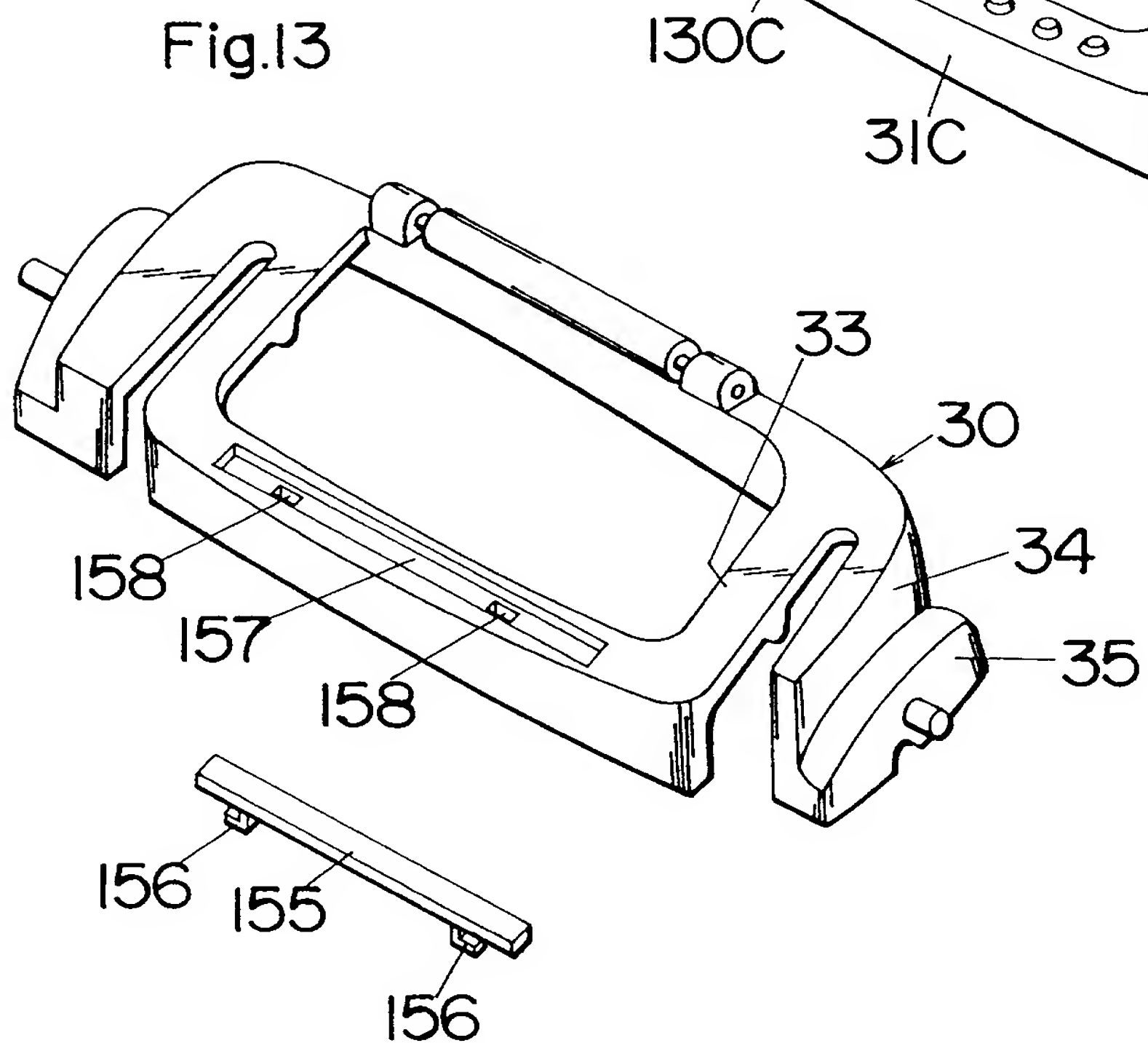
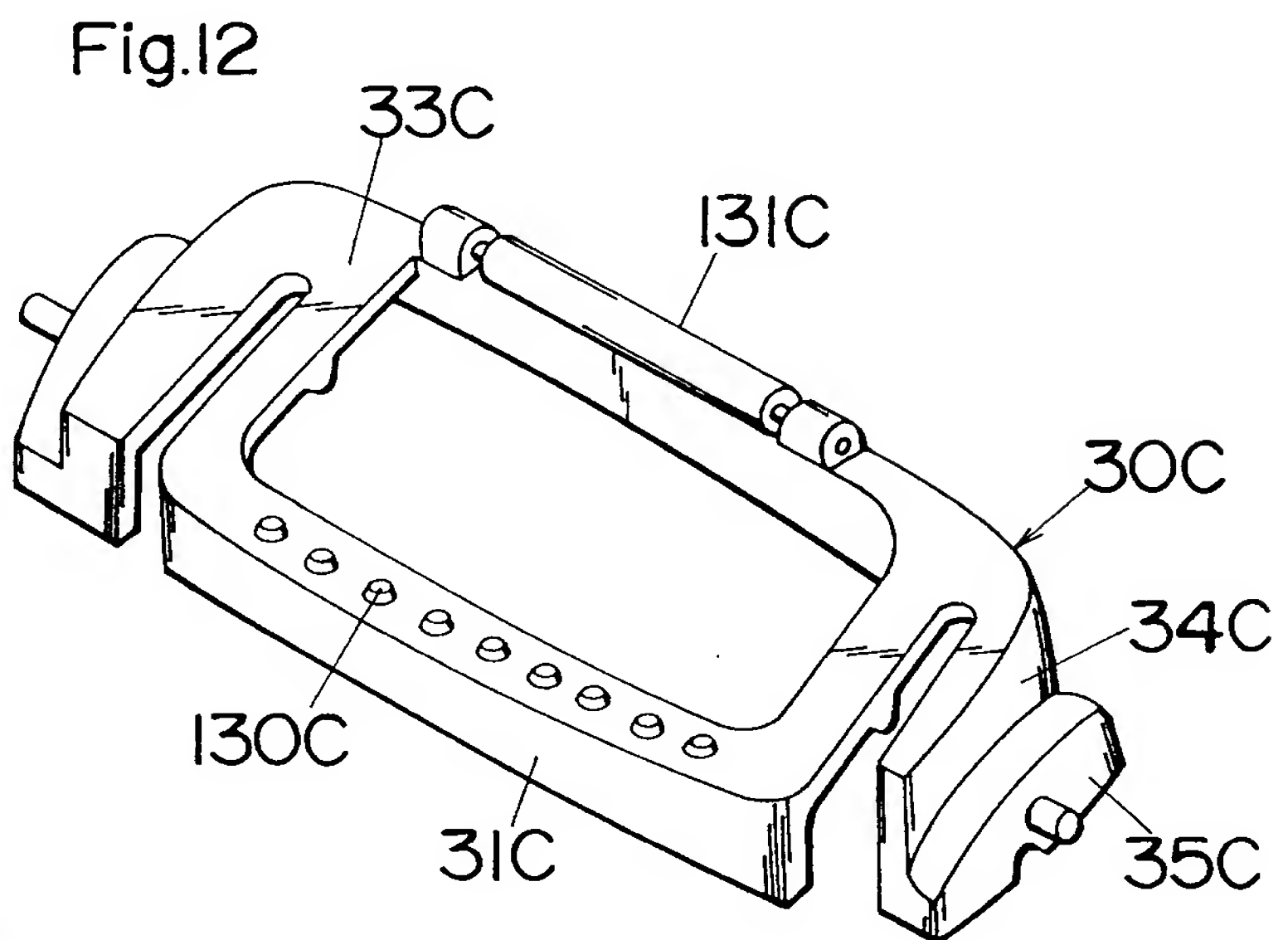
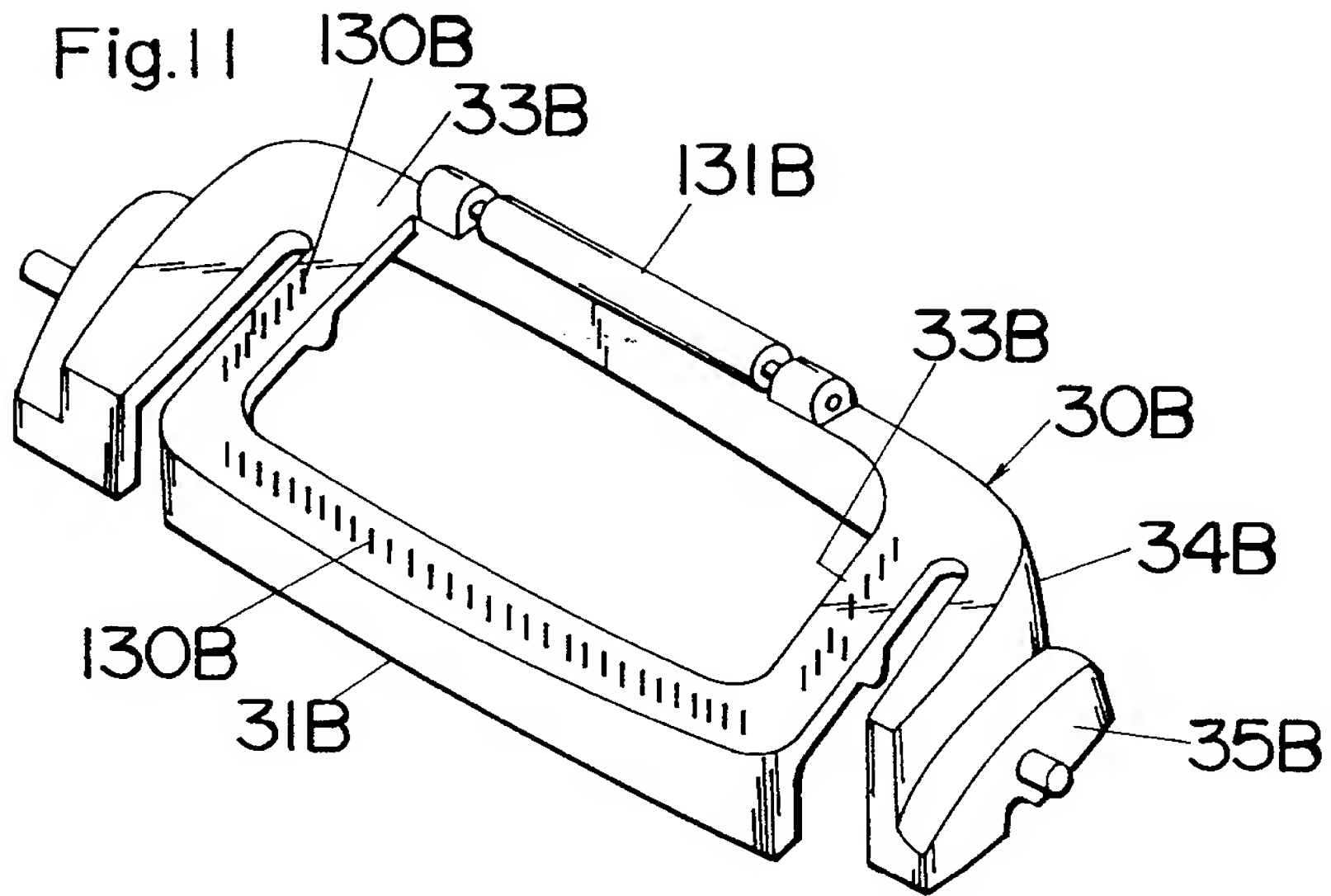


Fig.14

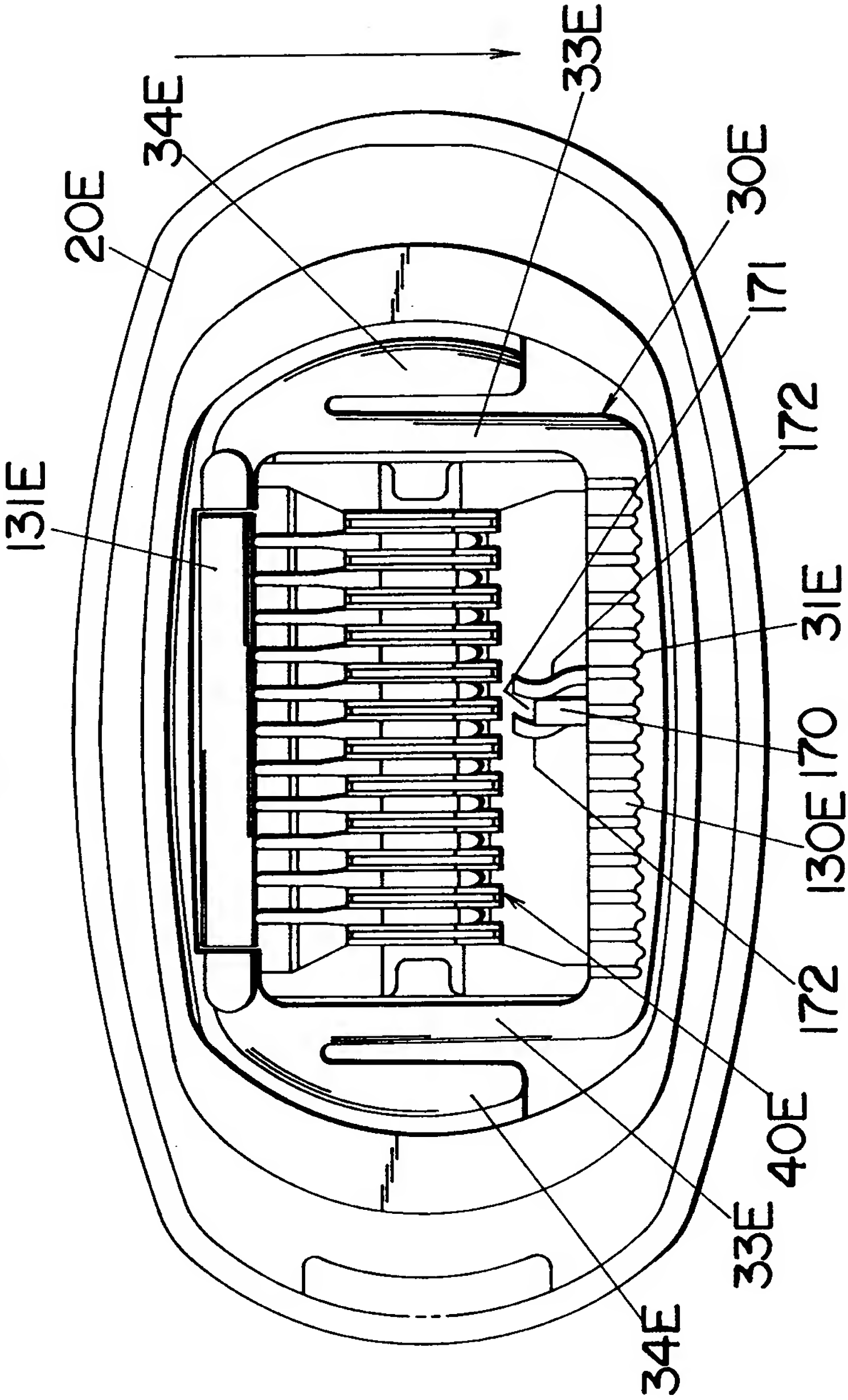


Fig.15

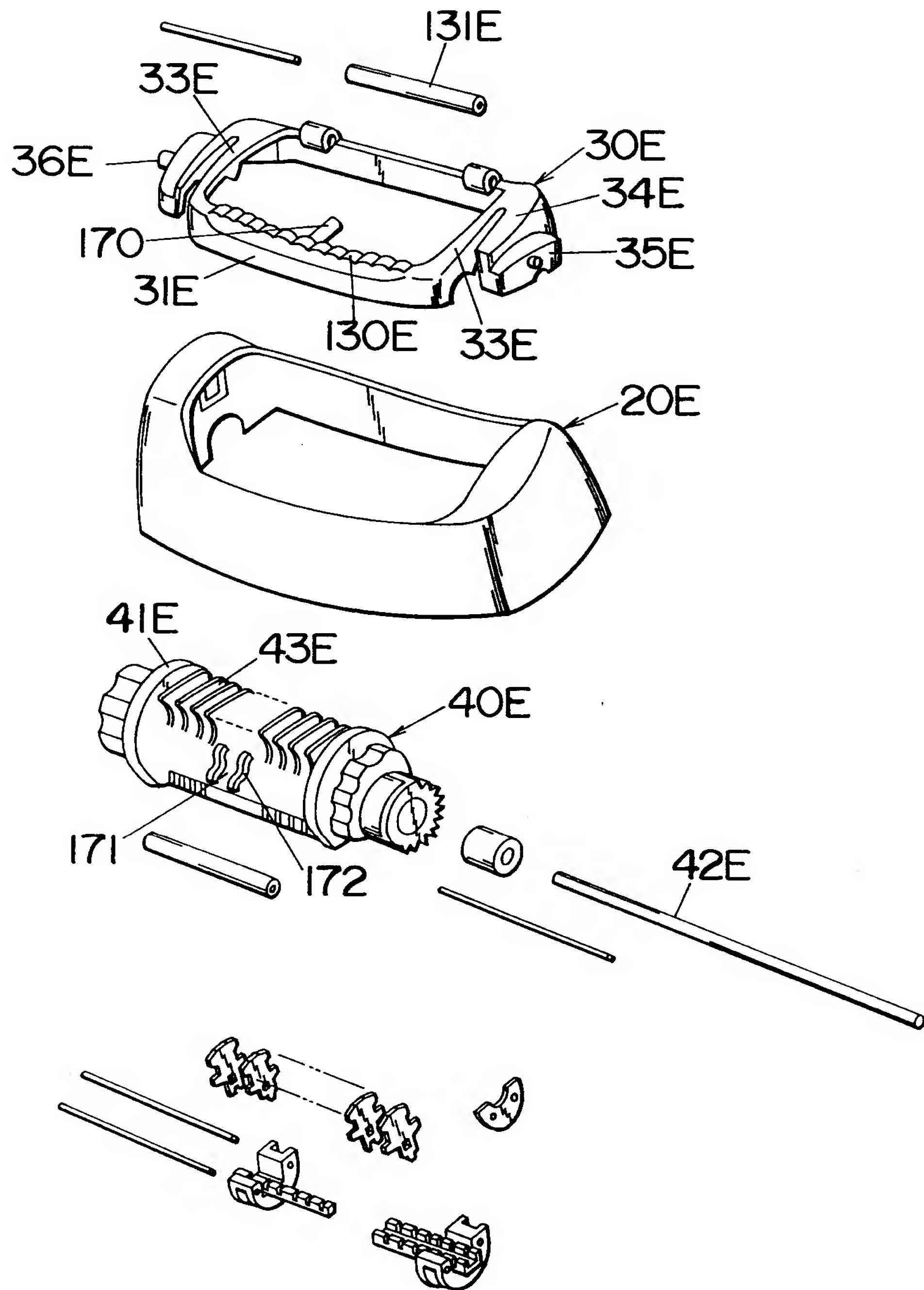
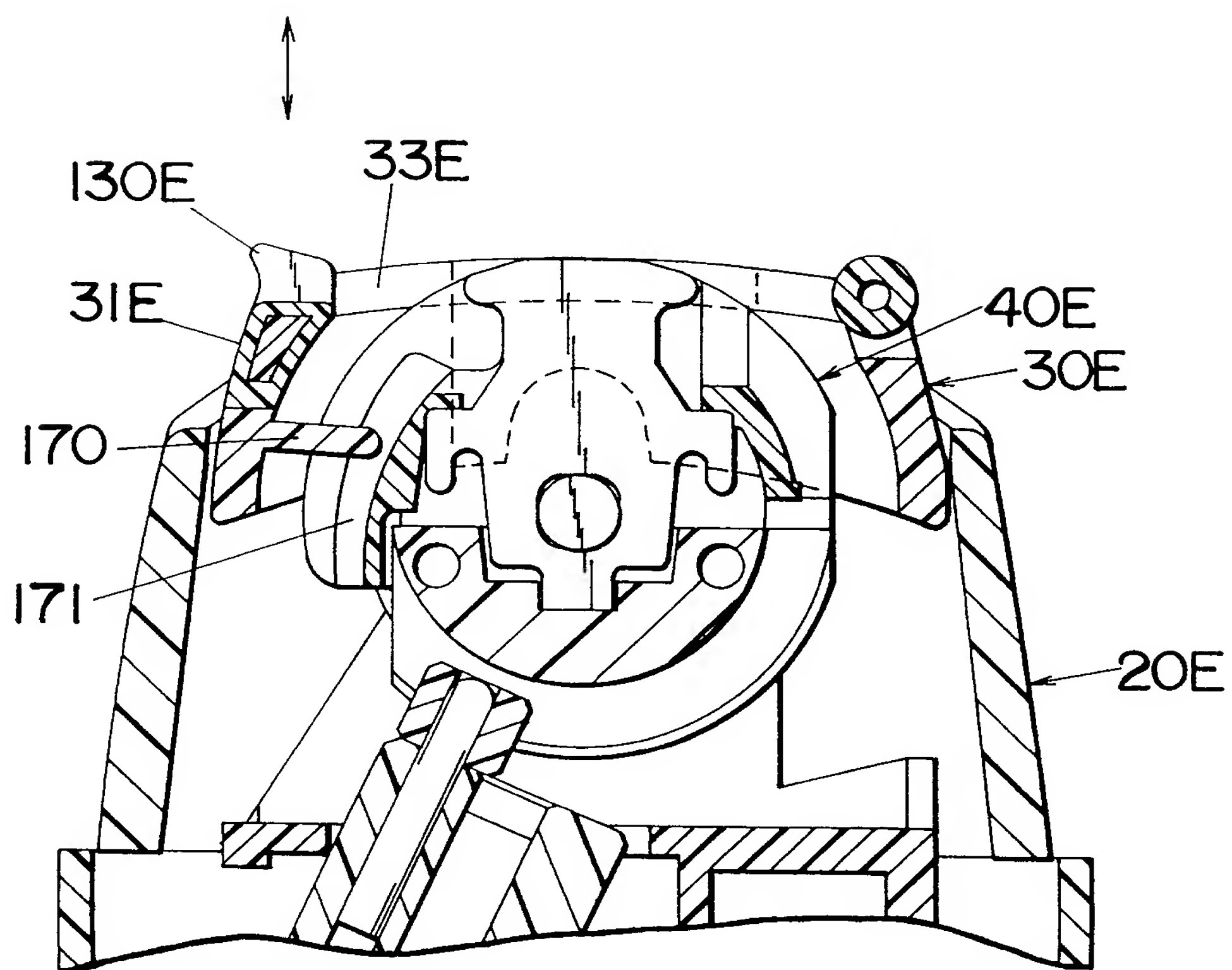


Fig.16



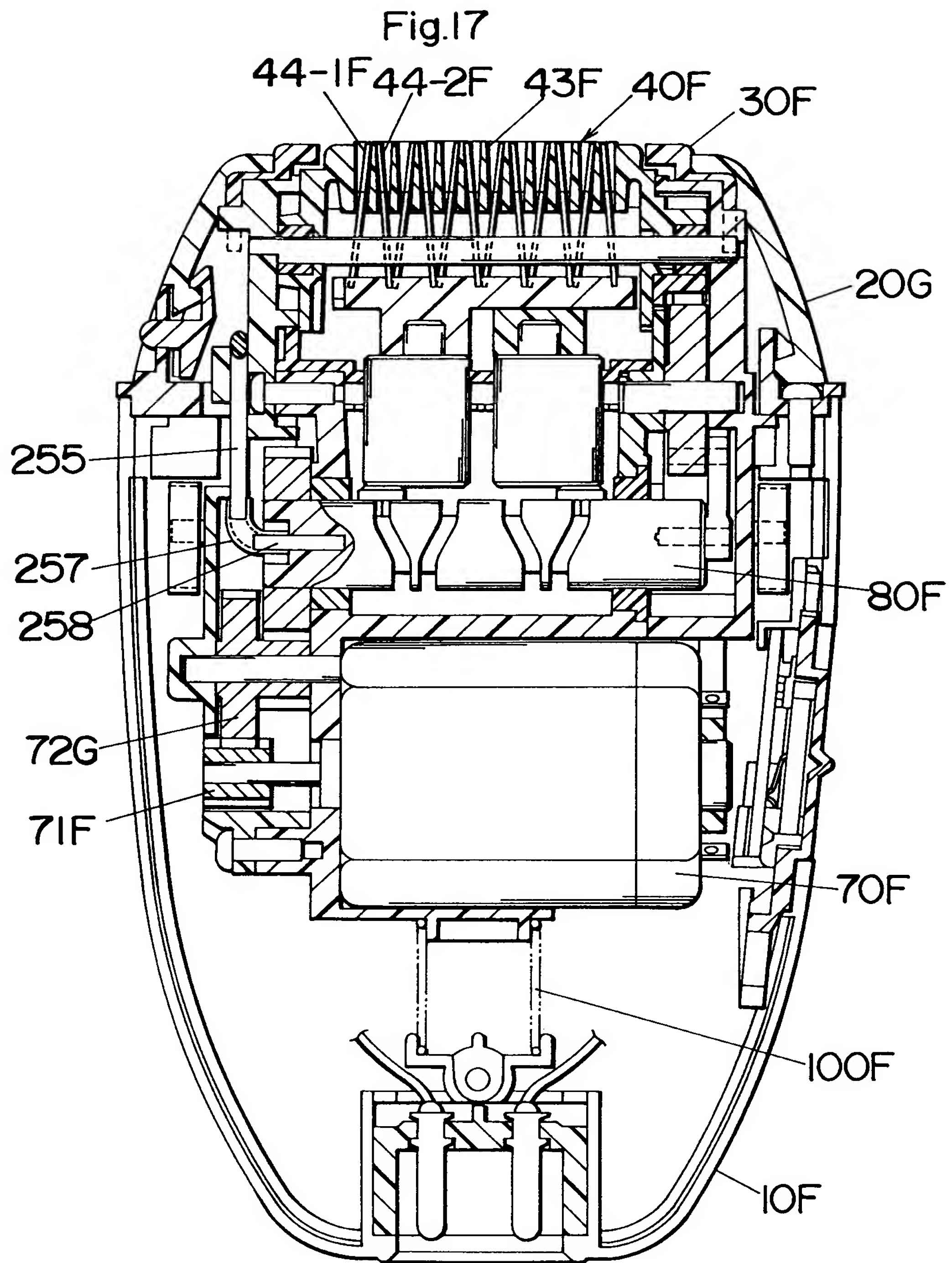
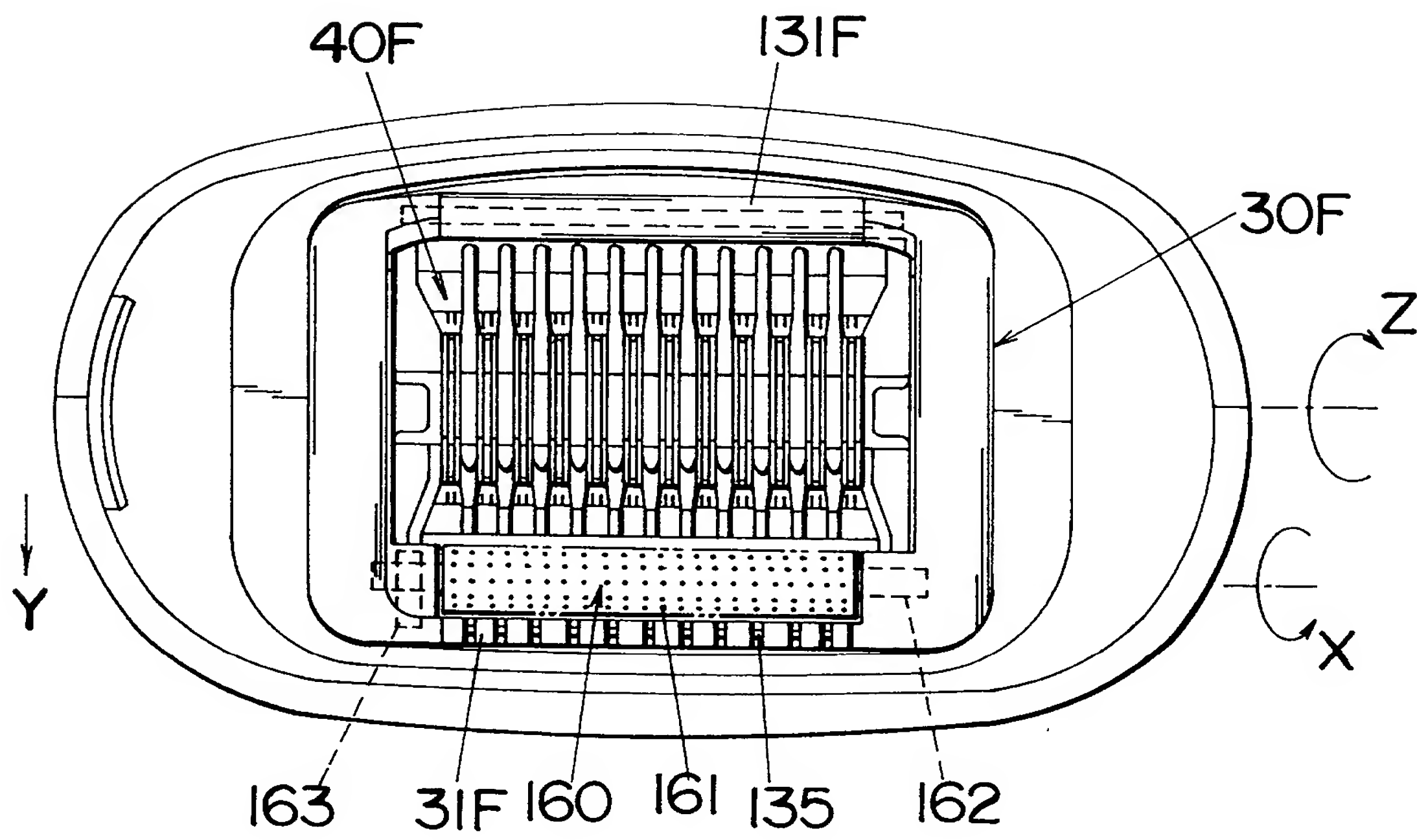


Fig.18



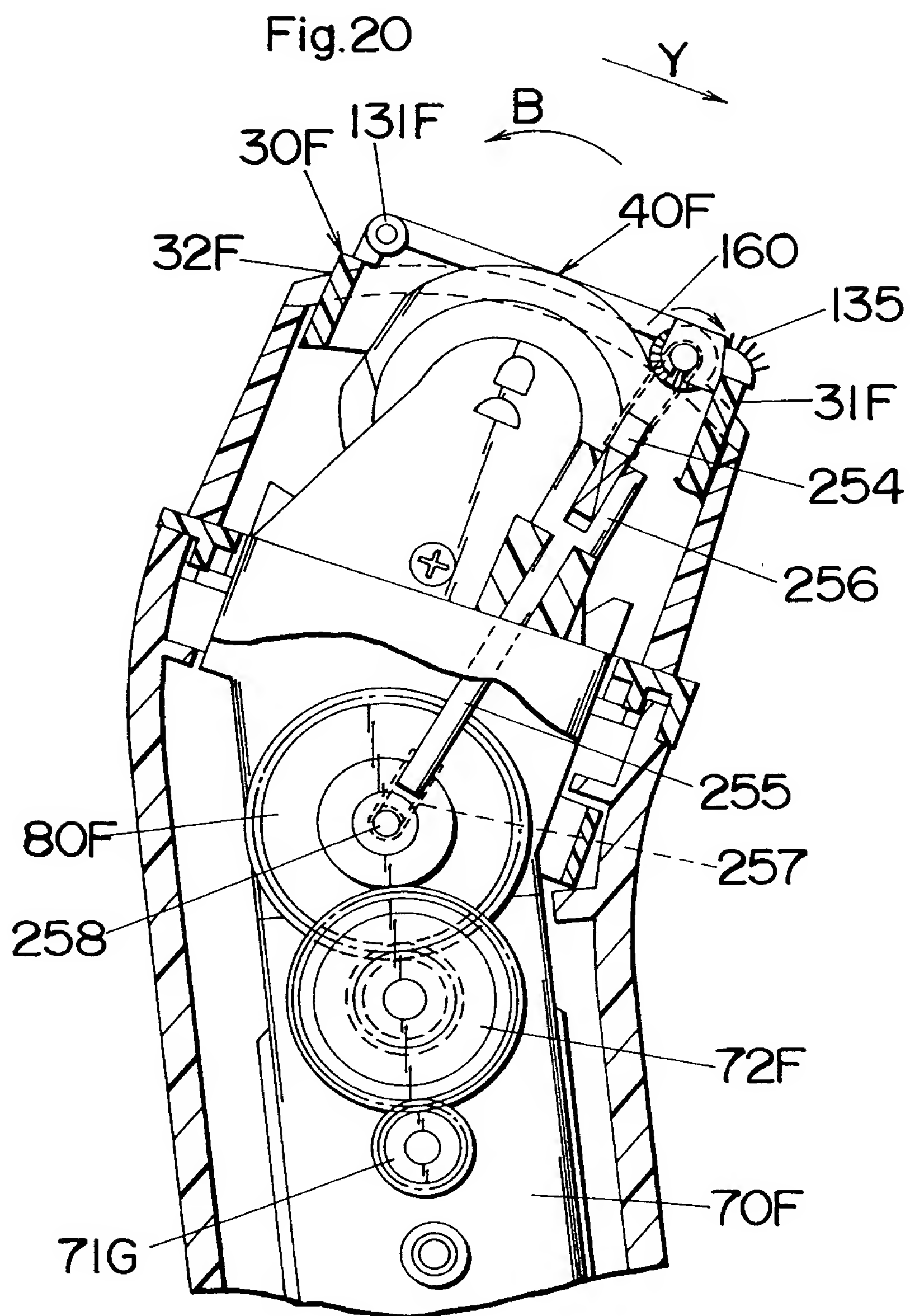
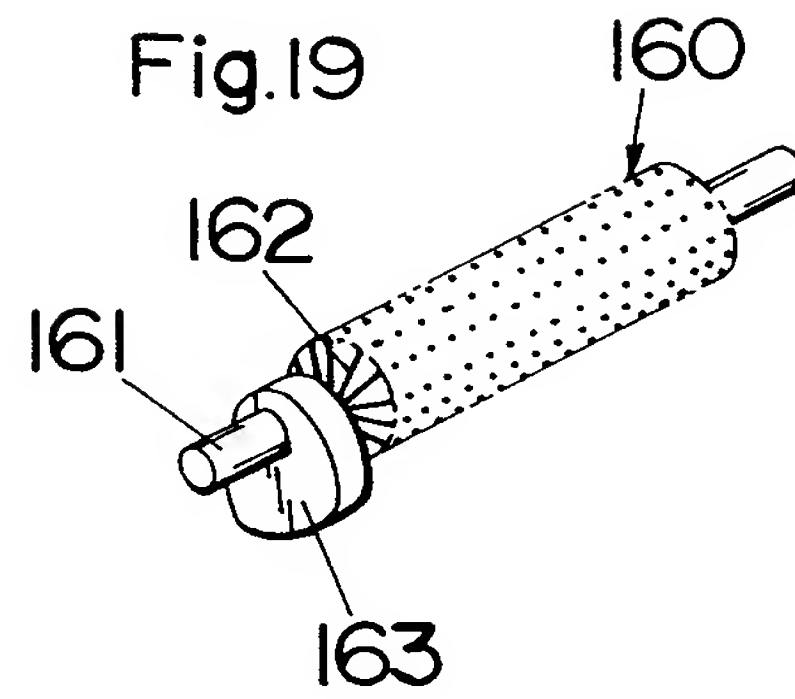
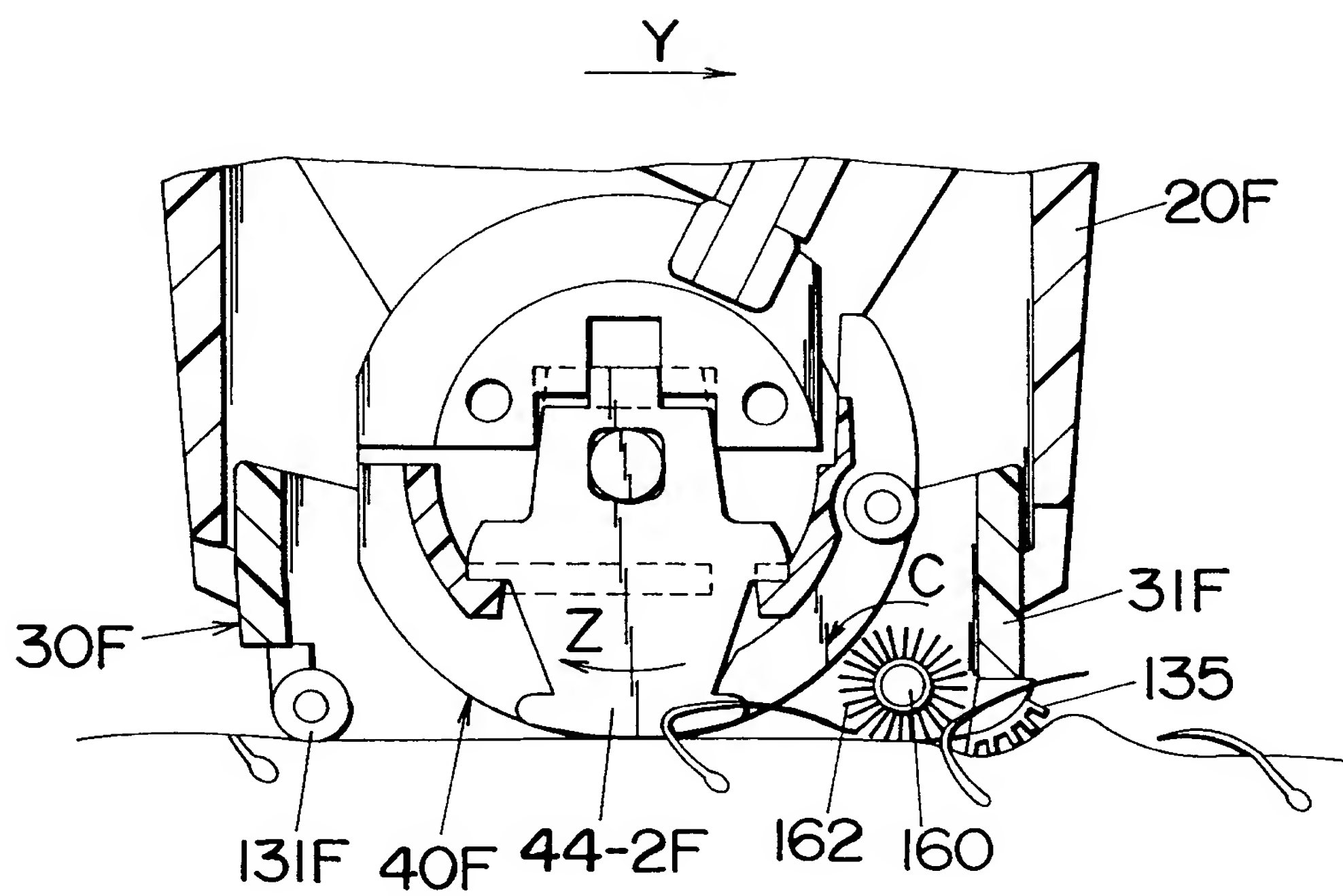


Fig.2I



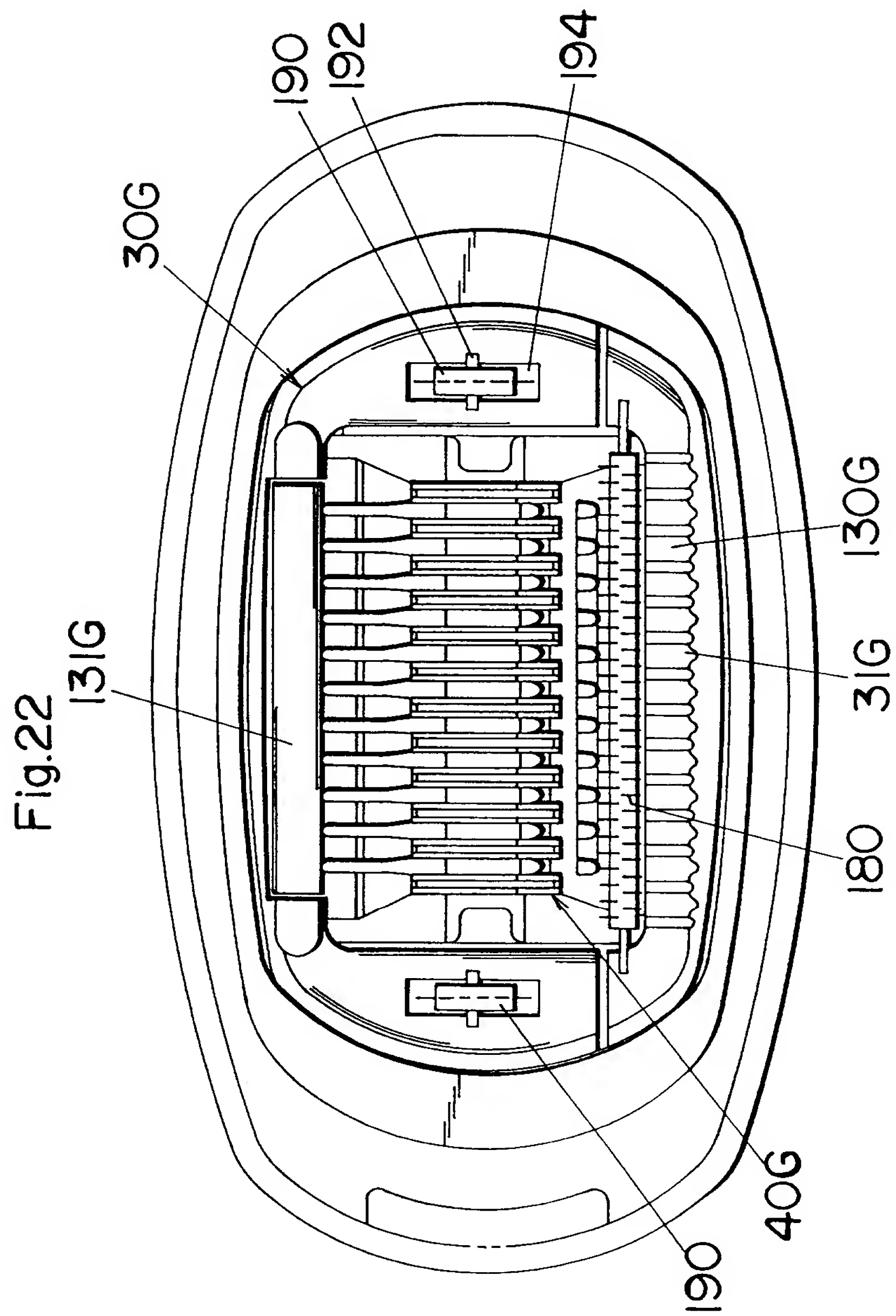


Fig.23

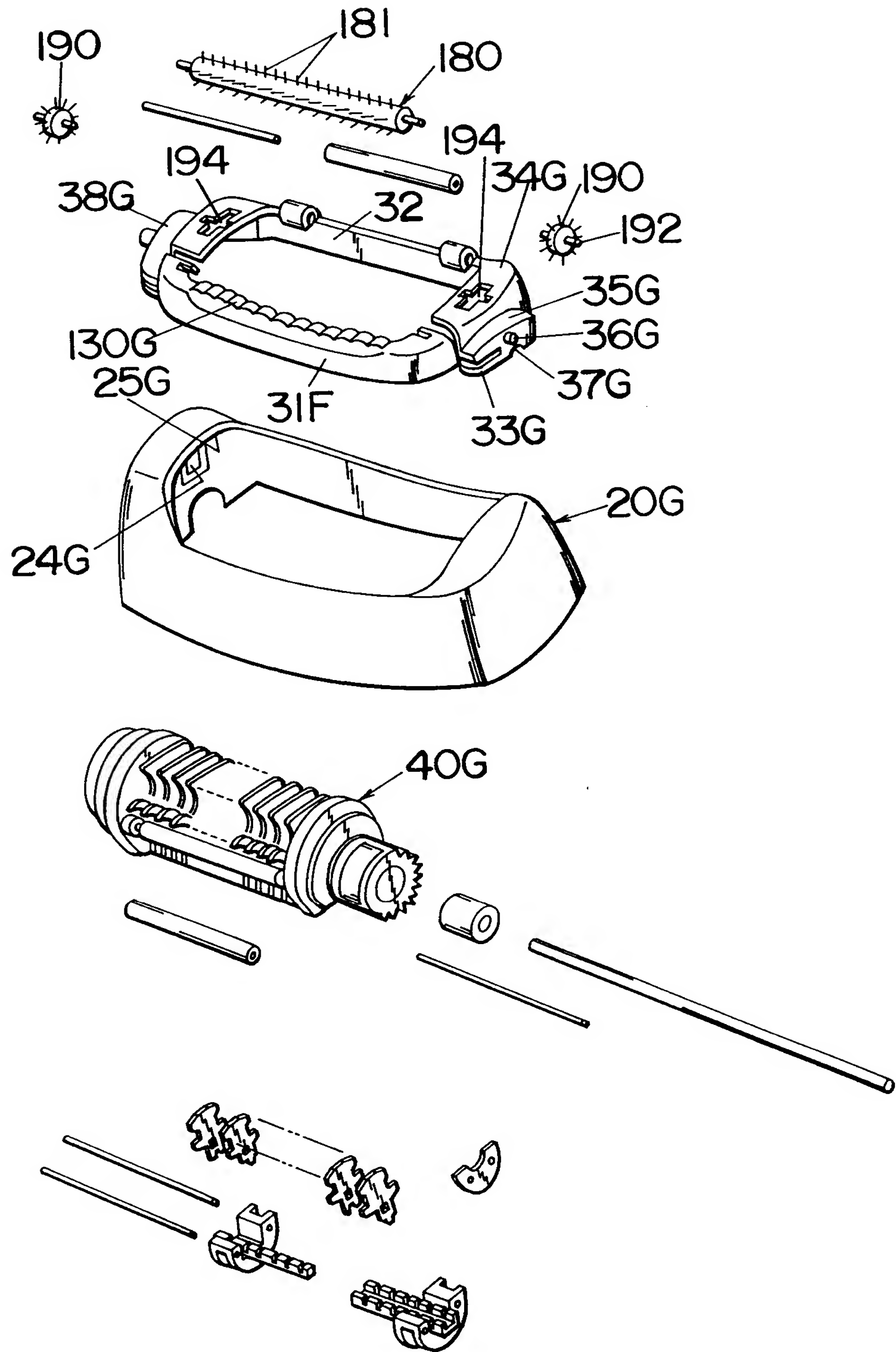


Fig.24

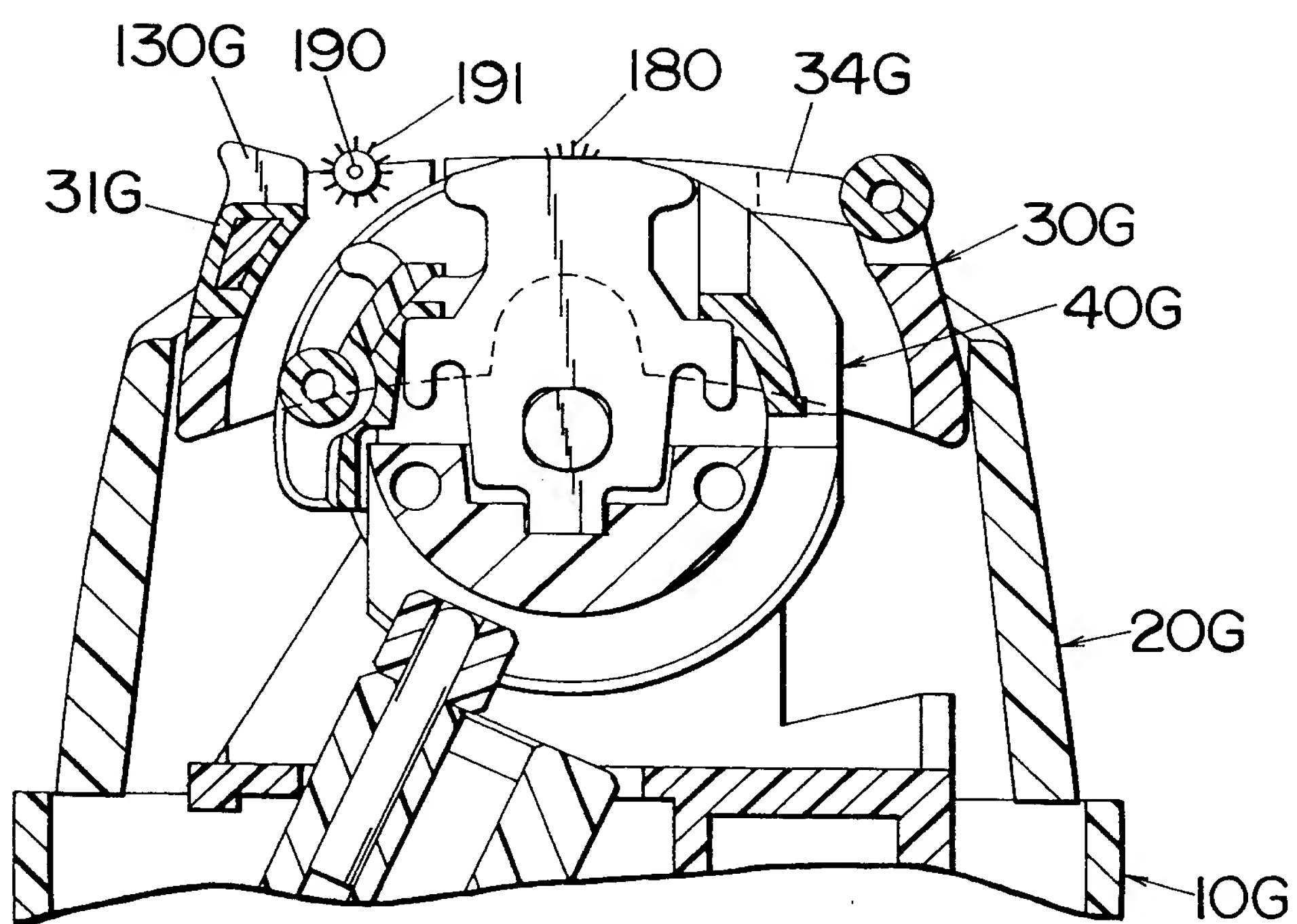


Fig.25

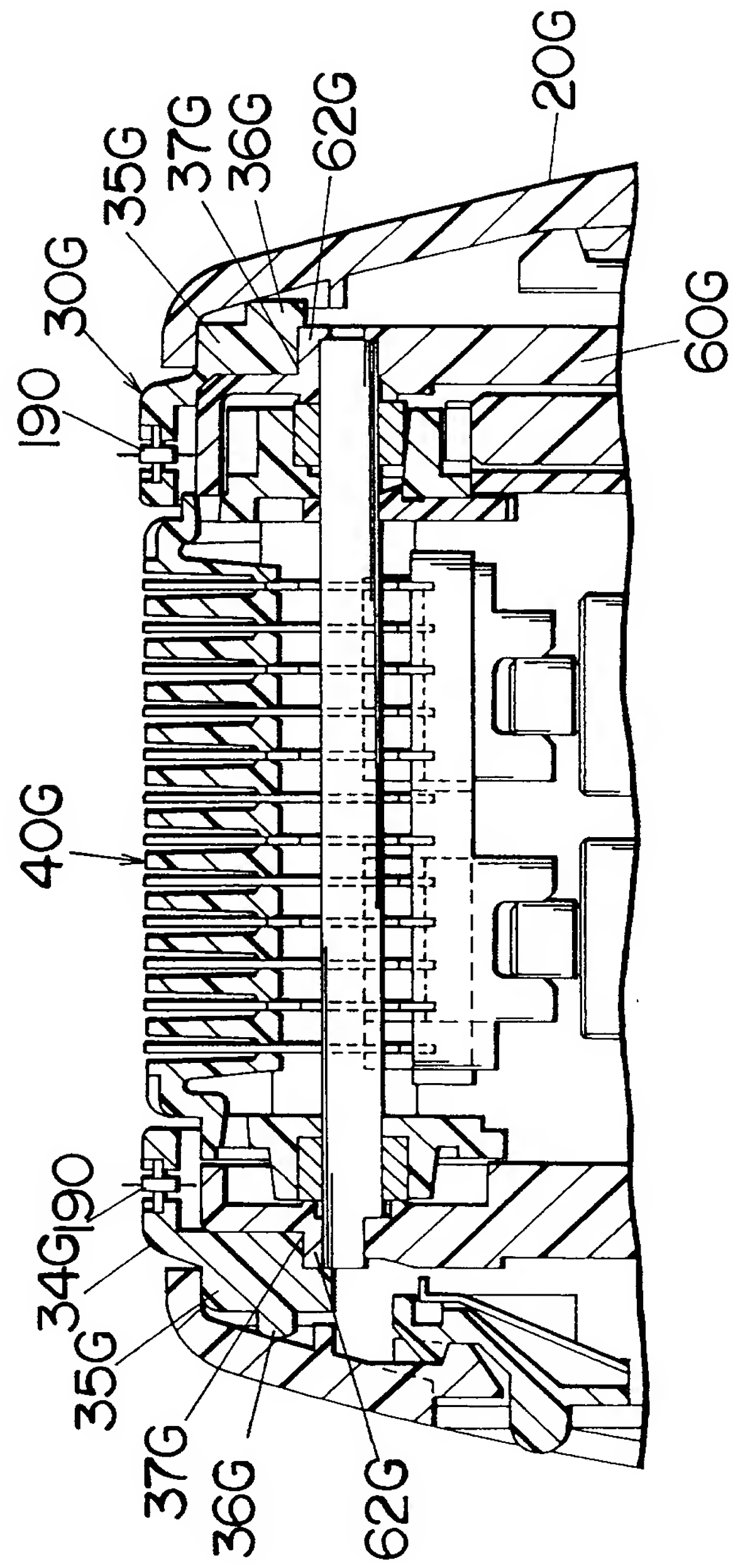


Fig.26A

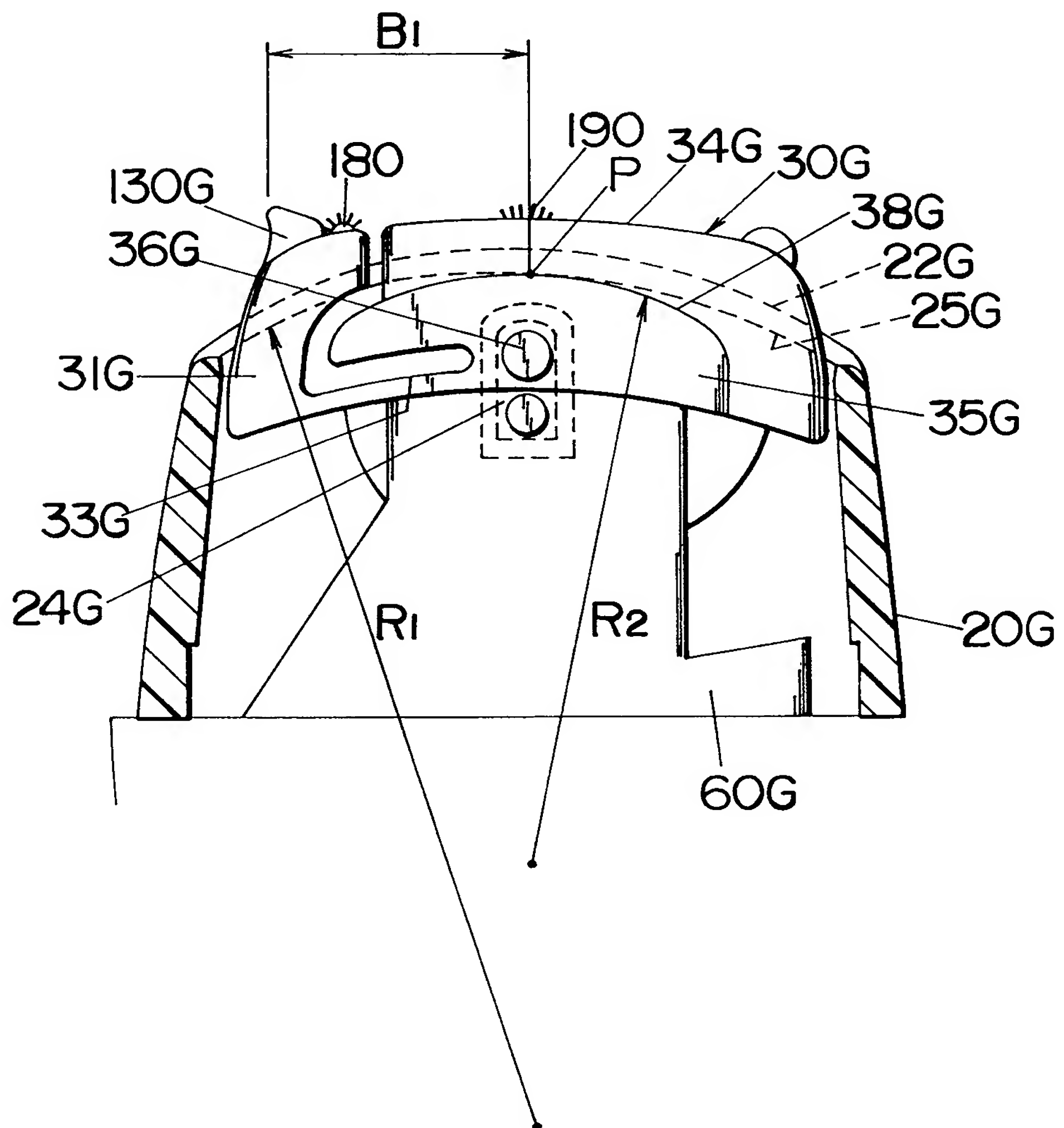


Fig.26B

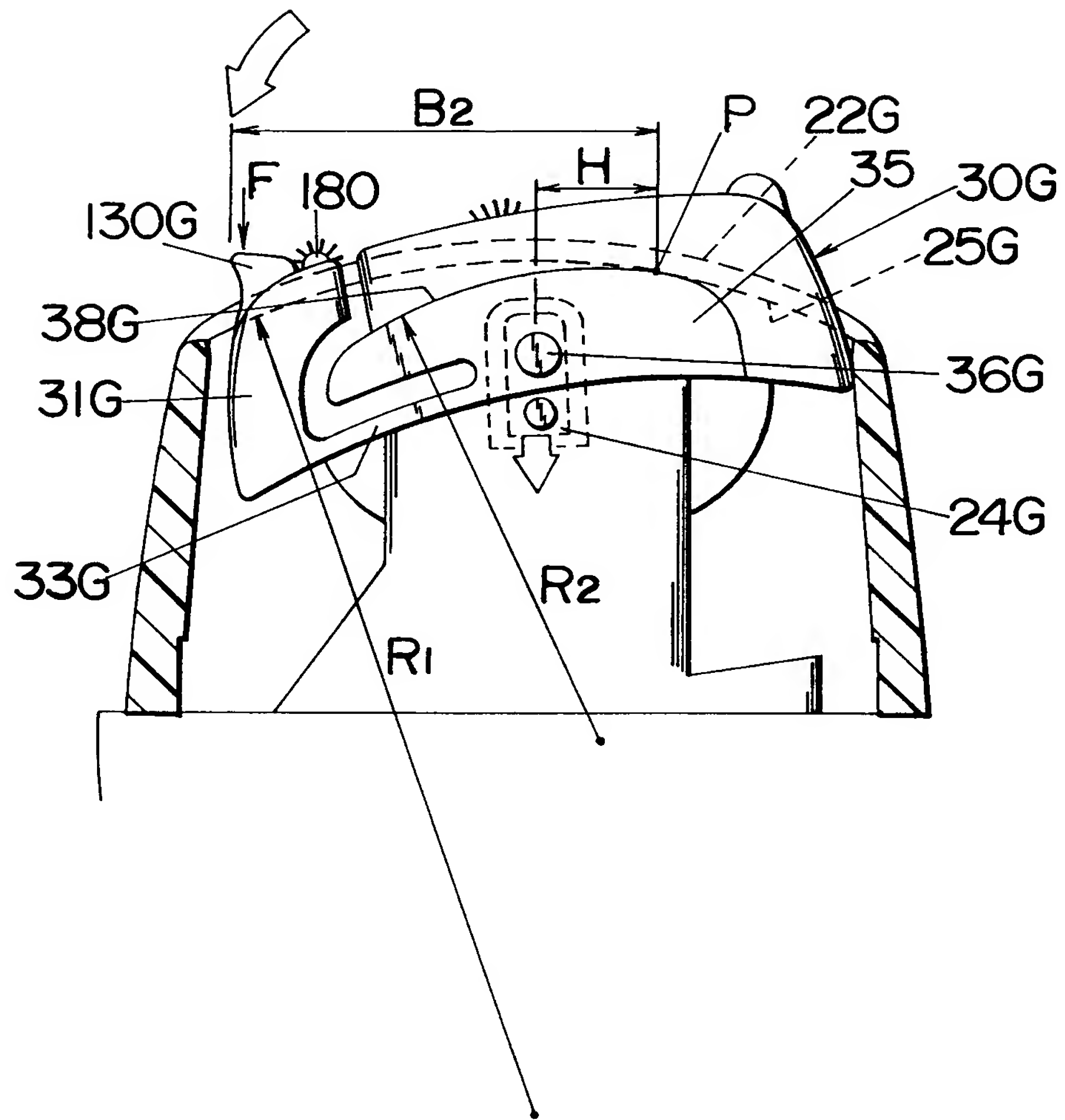


Fig.27A

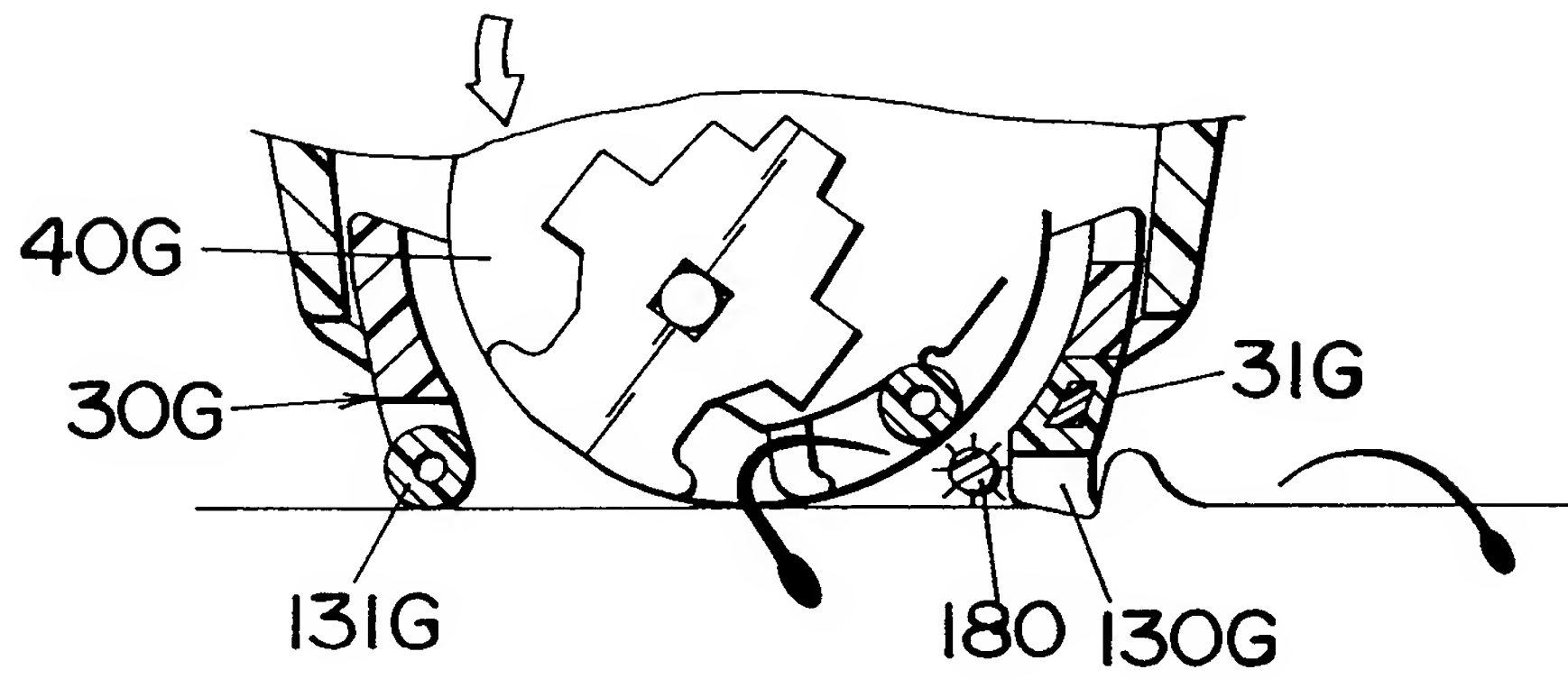


Fig.27B

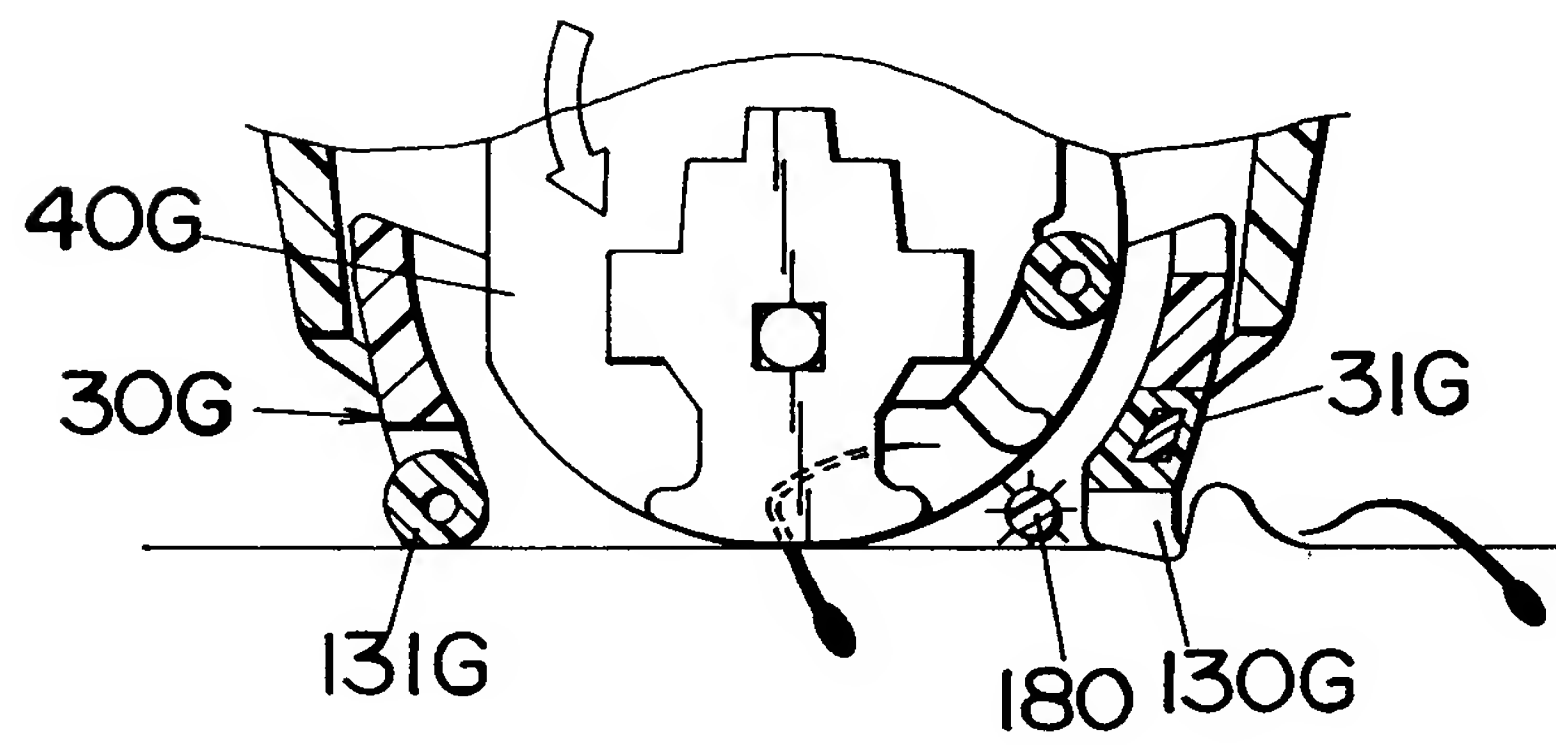


Fig.27C

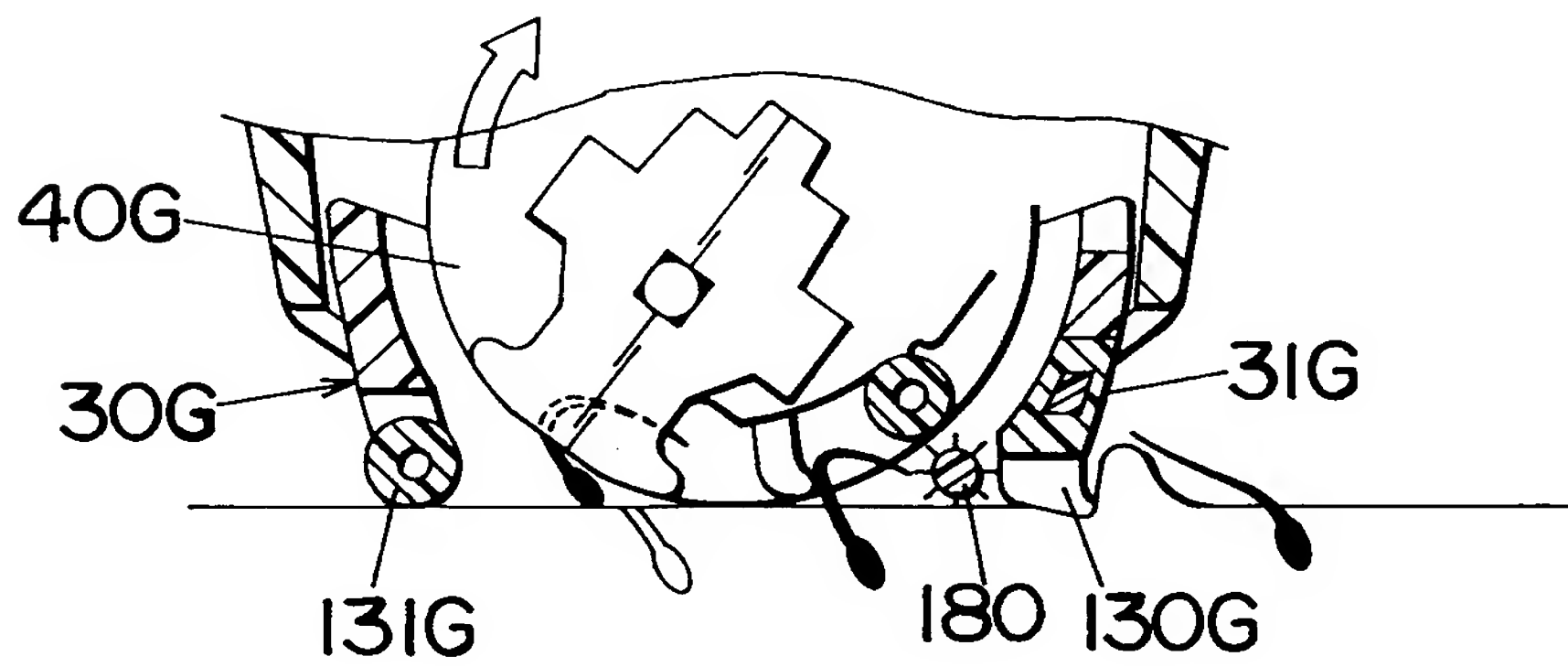


Fig.28

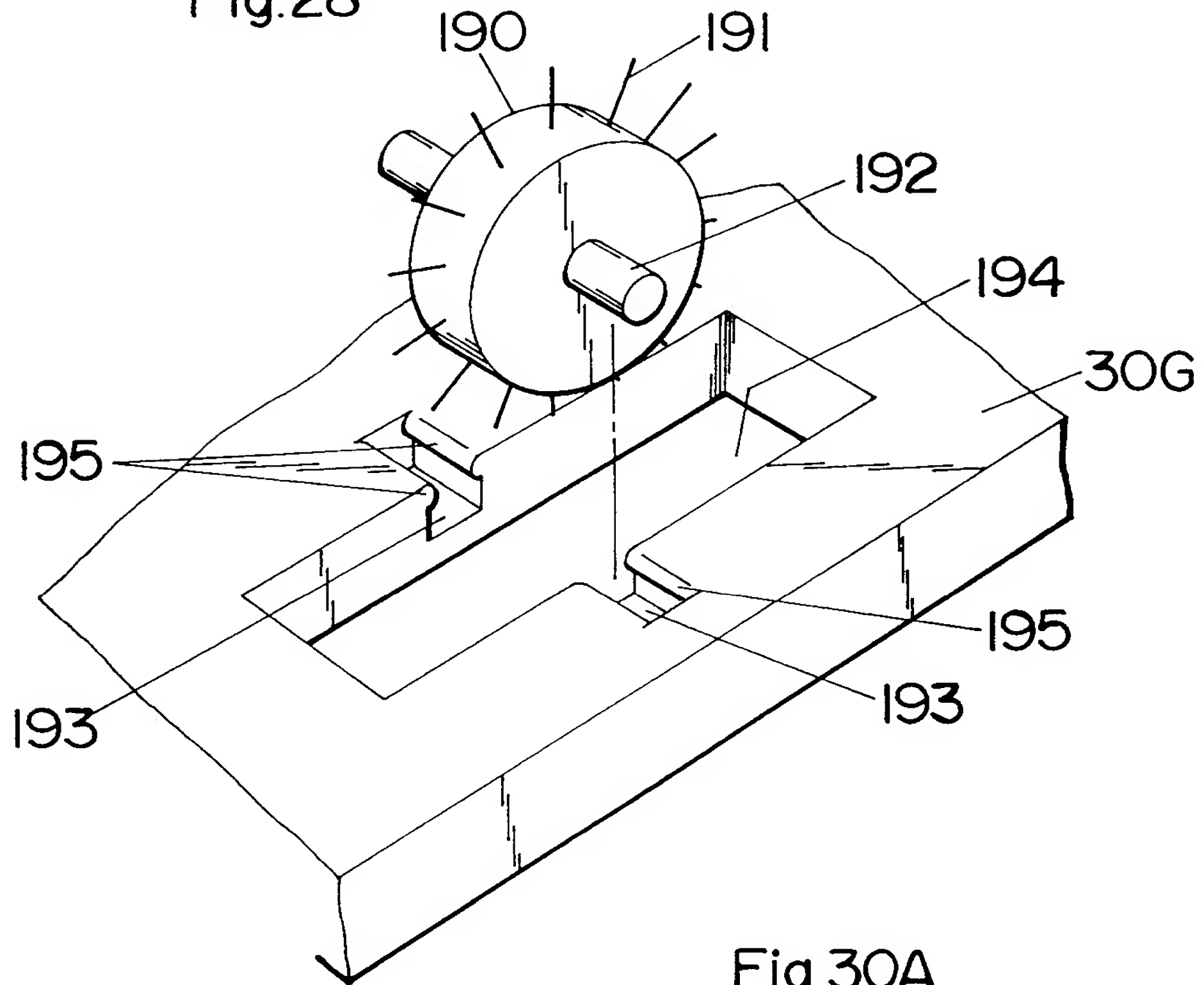


Fig.30A

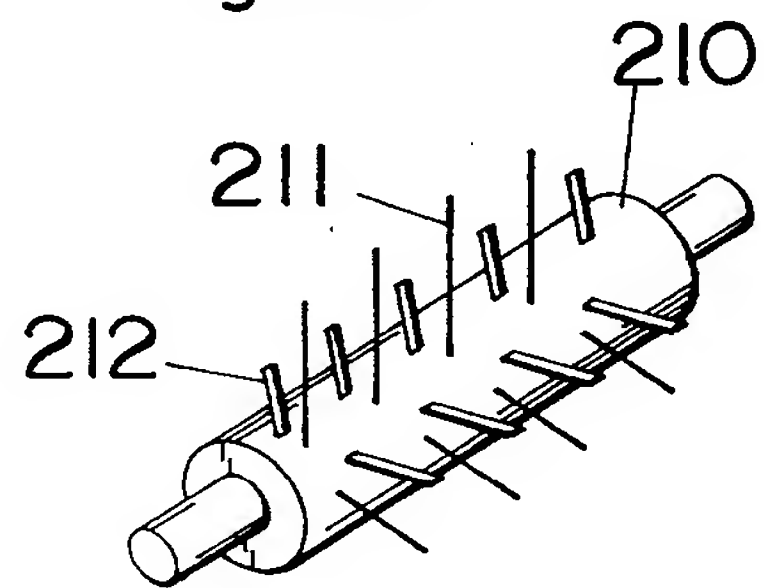


Fig.29A

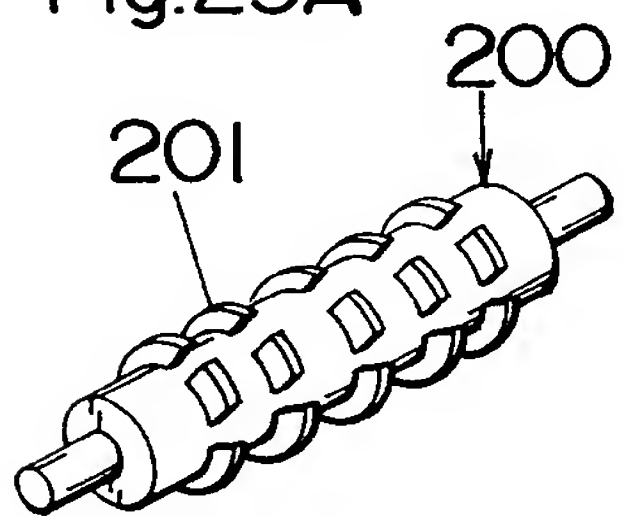


Fig.29B

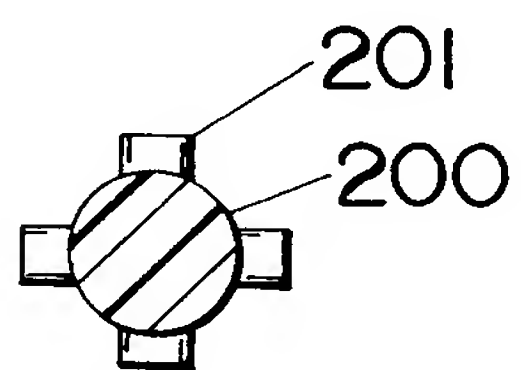


Fig.30B

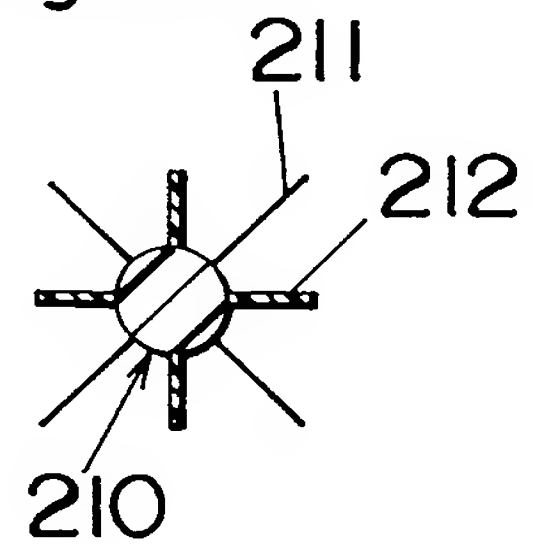


Fig.31A

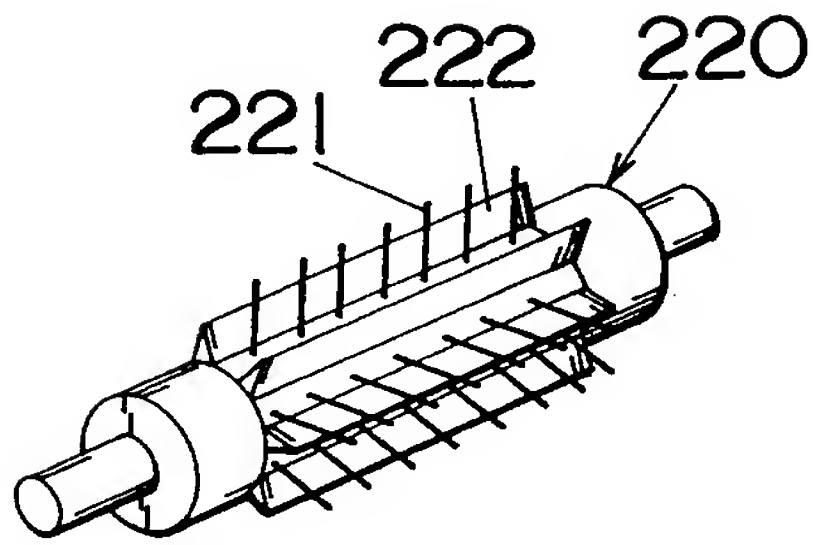


Fig.32A

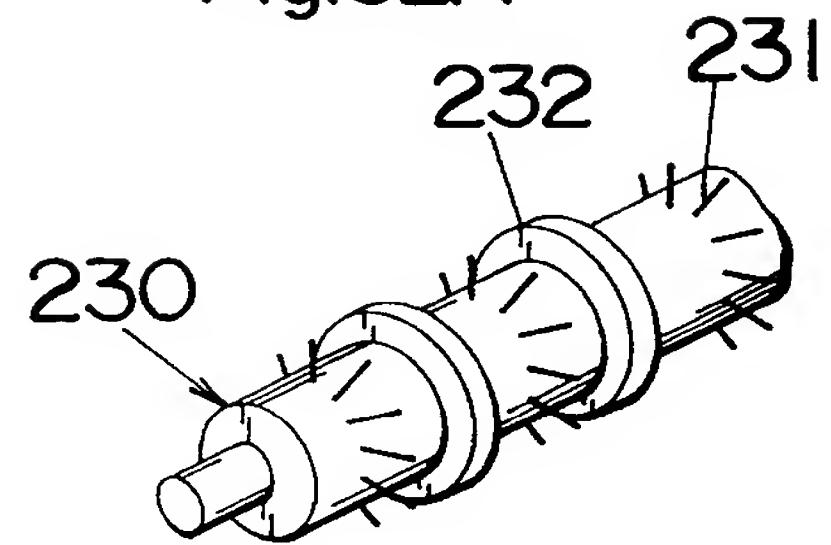


Fig.31B

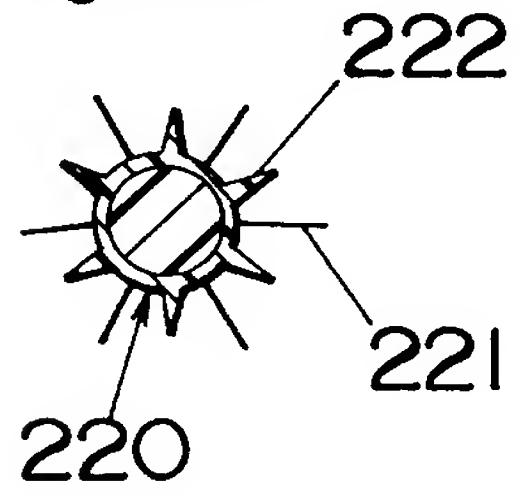


Fig.32B

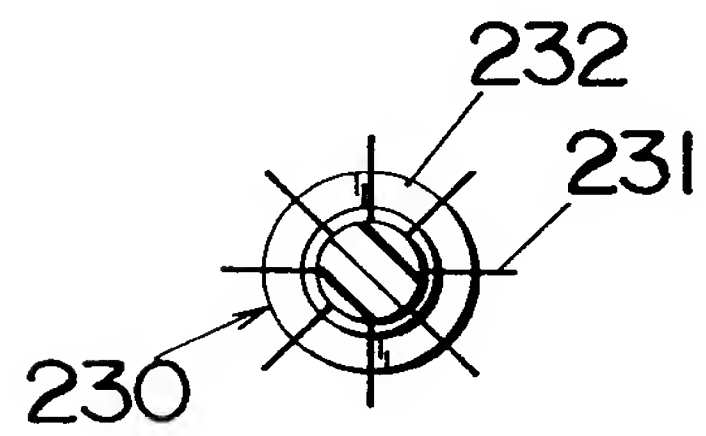
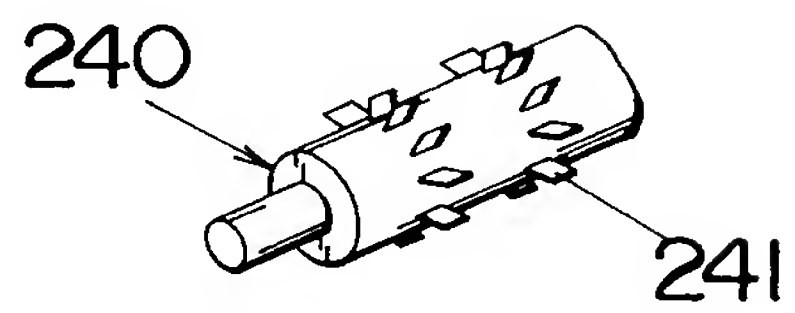


Fig.33





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 11 3656

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	EP-A-0 493 849 (N.V. PHILIPS) * the whole document *	1 10	A45D26/00
A	US-A-5 011 485 (DAAR) * column 10, line 56 - column 11, line 28; figures 16-19 *	1,3,10	
D,A	EP-A-0 622 033 (MATSUSHITA ELECTRIC WORKS) * the whole document *	1,4,10	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A45D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14 November 1996	Examiner Sigwalt, C
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.92 (POMC01)

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 0 760 219 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
10.10.2001 Bulletin 2001/41

(51) Int Cl.7: **A45D 26/00**

(21) Application number: **961 13656.1**

(22) Date of filing: **26.08.1996**

(54) **Hand-held depilating device**

Handenthaarungsvorrichtung

Appareil d'épilation portatif

(84) Designated Contracting States:
DE FR

(30) Priority: **28.08.1995 JP 21911695**
03.10.1995 JP 25657595
15.05.1996 JP 12069396

(43) Date of publication of application:
05.03.1997 Bulletin 1997/10

(60) Divisional application:
00115223.0 / 1 044 624

(73) Proprietor: **MATSUSHITA ELECTRIC WORKS,**
LTD.
Kadoma-shi Osaka 571 (JP)

(72) Inventors:
• **Iwasaki, Jyuzaemon**
Kadoma-shi, Osaka (JP)
• **Tanahashi, Masao**
Kadoma-shi, Osaka (JP)
• **Takegawa, Yoshinobu**
Kadoma-shi, Osaka (JP)
• **Asada, Mika**
Kadoma-shi, Osaka (JP)

(74) Representative: **Goddar, Heinz J., Dr. et al**
FORRESTER & BOEHMERT
Pettenkoferstrasse 20-22
80336 München (DE)

(56) References cited:
EP-A- 0 493 849 **EP-A- 0 622 033**
US-A- 5 011 485

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 0 760 219 B1

Description

TECHNICAL FIELD

[0001] The present invention is directed to a hand-held depilating device for plucking hairs from the skin of a user, and more particularly to such device having a stimulator providing mechanical stimuli to the skin for masking the pain of plucking the hairs.

BACKGROUND ART

[0002] European Patent Application EP-A-0 622 033 A2 discloses a depilating device which comprises a plucking head for plucking the hairs from the skin of a user and a smooth roller which is mounted separately from the plucking head to be in rolling contact with the skin around a portion from which the hairs are plucked by the plucking head. The roller acts to stretch the skin for alleviating pain by the effect of reducing resistance to a force of pulling the hairs. However, even with the skin stretching, there remains a problem that the pain itself may be perceived still significantly by the user.

[0003] In order to further alleviate the pain experienced at the time of plucking the hairs, the inventors study mechanism of pain including nerve systems as well as sense receptors in the skin. Through this study, it is found effective to give mechanical stimuli to the skin in order to considerably alleviate the pain caused by plucking the hairs. The present invention is accomplished based upon the above finding and comprises a depilator housing adapted to be grasped by the hand of the user and a plucking head mounted on top of the housing for plucking the hairs from the skin. Stimulator is mounted on top of the housing adjacent to the plucking head for providing mechanical stimuli to the skin while the plucking head operates to pluck the hairs. Therefore, the mechanical stimuli applied separately from the plucking operation can excite the tactile or pressure sense receptors so as to activate the gate control path at posterior horn of the spinal cord immediately before or simultaneously with the plucking the hair, thereby blurring the pain being transmitted through the nerve. EP 0 493 849 A1 discloses a depilation device, where, immediately prior to depilation, a vibration member is brought into contact with the skin to be depilated which member exerts forces of varying intensity on the skin whereby the nerve function in the skin is affected.

[0004] It is the problem of the invention to provide for an alternative of the known device, in particular where null functions are prevented.

[0005] This object is solved by the depilation device of claim 1.

[0006] According to the invention, the stimulator comprises a roller with a plurality of stimulus projections which provide the mechanical stimuli to the skin as the roller is caused to rotate in contact with the skin. The mechanical stimuli thus produced separately from the

plucking operation can excite the tactile or pressure sense receptors so as to mask the pain caused by plucking the hair in the same manner as discussed hereinbefore. As the plucking head is manipulated across the skin, the roller is caused to rotate so that the stimulus projections apply the mechanical stimulus. In this manner, the mechanical stimuli can be obtained with a simple mechanism of using the roller, which is therefore a further object of the present invention.

[0007] The stimulus projections are preferably in the form of bristles projecting radially from the roller.

[0008] Preferably, the roller is carried on a skin guide frame which is floatingly supported to the housing so that the stimulus projections on the roller can easily follow the various portions of the skin while manipulating the plucking head thereacross. With this result, the mechanical stimuli can be applied effectively to the skin, which is therefore a still further object of the present invention.

[0009] An adjusting mechanism is provided to adjust a projection amount of the stimulus projections from the top of the housing so that the user can select optimum mechanical stimulus for alleviating the pain. In addition, the roller may be detachably mounted to the housing so that it can be replaced with another roller of different stimulating characteristic. Thus, the user can select optimum stimulation effect for various portions of skin and for her own preference, which is therefore a further object of the present invention.

[0010] In a preferred embodiment, the plucking head is floatingly supported to the housing to be capable of being depressed and is surrounded by a skin guide frame. The skin guide frame comprises a main body which is connected to the plucking head to be capable of being depressed together therewith and a front guide which is movably supported to the main body for limited displacement relative to the main body. The roller is supported to the front guide so that the roller can be depressed for a limited extent independently of the plucking head after which it can be depressed together with the plucking head. In this manner, the roller can well follow the contour of the skin while manipulating the plucking head thereacross, thereby enhancing the effect of the mechanical stimuli for alleviation of the pain, which is therefore a further object of the present invention.

[0011] Further, the skin guide frame is supported to be swingable about a swing axis while it is depressed together with the plucking head. With the combination of the depressing and swinging movements of the skin guide frame relative to the housing, the roller on the skin guide frame can follow the skin more precisely while manipulating the plucking head thereacross. Thus, the mechanical stimuli can be applied effectively and successfully to the skin for further enhancing the alleviation of the pain. In order to achieve such sophisticated movement, the skin guide frame is engaged on a rounded portion of the housing at a point of contact defining the swing axis. As the skin guide frame swings, the point of

contact is made to move along the rounded portion of the housing in a direction of facilitating an attendant depression of the skin guide frame together with the plucking head. Thus, the roller carried on the skin guide frame can follow the skin more conformably to achieve superior effect of alleviating the pain.

[0012] These and still other objects and advantageous features of the present invention will become more apparent from the following description of the embodiments when taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is a top view of a depilating device in accordance with an embodiment of the present invention; FIG. 2 is an exploded perspective view of the device of FIG. 1;

FIG. 3 is a side section of a plucking head and a skin guide frame of the device;

FIG. 4 is a front vertical section of the plucking head; FIGS. 5A and 5B are side sections showing a combination swing and depression movement of the skin guide frame;

FIGS. 6A, 6B, and 6C show a hair plucking operation with the aid of a roller with stimulus projections carried by the skin guide frame;

FIG. 7 is an exploded perspective view of a mechanism of detachably mounting one of the rollers to the skin guide frame;

FIGS. 8A and 8B are perspective and sectional views of a first alternative roller which may be utilized in the above depilating device;

FIGS. 9A and 9B are perspective and sectional views of a second alternative roller which may be utilized in the above depilating device;

FIGS. 10A and 10B are perspective and sectional views of a third alternative roller which may be utilized in the above depilating device;

FIGS. 11A and 11B are perspective and sectional views of a fourth alternative roller which may be utilized in the above depilating device; and

FIG. 12 is a perspective view of a fifth alternative roller which may be utilized in the above depilating device.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0014] In a depilator device in accordance with an embodiment of the present invention at least one roller is mounted adjacent to like plucking head to apply the mechanical stimuli to the skin as it is caused to rotate by contact with the skin. The roller **180** is disposed in generally parallel with and immediately behind a front bar **31G** of a skin guide frame **30G** to be freely rotatable about an axis of a shaft **182** the opposite ends of which

are supported to bearing slots **183** in the opposite ends of the front bar **31G**. The roller **180** carries a plurality of radially projecting bristles **181** arranged circumferentially and axially over a corresponding length of the plucking head **40G**. A pair of additional rollers **190** are mounted respectively on the guide frame **30G** axially outwardly of the plucking head **40G**. Each of the additional rollers **190** is also supported to be freely rotatable about an axis of a shaft **192** and carries a plurality of radially projecting bristles **191**. These rollers **180** and **190** are made into rolling contact with the skin and caused to rotate as the plucking head **40G** is manipulated to move across the skin, during which the bristles **181** and **191** apply the mechanical stimuli to the skin for alleviating the pain of plucking the hairs.

[0015] The skin guide frame **30G** is made of a plastic material into a unitary structure of a generally rectangular configuration composed of the front bar **31G**, rear bar **32G**, and opposed end support **34G** integrally connecting the front and rear bars. The front bar **31G** is connected to the end supports **34G** at its opposite ends respectively through resilient members **33G** so that the front bar **31G** is allowed to move vertically within a limited extent relative to the other portion of the guide frame **30G**. The end support **34G** is provided with a recess **194** for receiving the additional roller **190**. The roller **180** supported by the front bar **31G** is allowed to be depressed together with the front bar **31G** relative to the other portion of the guide frame **30G** for a limited extent after which it is depressed together with the guide frame **30G** and the plucking head **40G** relative to the head frame **20G**. In this manner, the roller **180** is made to easily follow the skin configuration. The front bar **31G** is formed with comb projections **130G** for smoothing and raising the hairs prior to plucking the same. It is noted here that the plucking head **40G** is floatingly supported by a spring mechanism comprising a coil spring as described in EP..... (divisional application to this one, attorney's file : FB60621A, so as to be depressed relative to the head frame **20G** and that the skin guide frame **30G** is held on the plucking head **40G** to receive the upward bias from the spring mechanism so as to be depressed together with the plucking head **40G**.

[0016] The rear bar **32G** carries a freely rotatable smooth roller **131G** which comes into rolling contact with the skin behind the plucking head **40G** for smoothly guiding the plucking head in the moving direction. FIGS. 6A to 6C illustrate the sequence of the plucking operation in which the plucking head **40G** moves from left to right in the figures while swinging about the longitudinal axis thereof as indicated by arrows for plucking the hairs. During this operation, the roller **180** and the additional rollers **190** (although not seen in these figures) are kept in rolling contact with the skin so that the bristles **181** and **191** thereof can apply the mechanical stimuli to the skin for masking the pain of plucking the hairs.

[0017] Also in this embodiment, the guide frame **30G** is formed on opposite ends thereof with like bearing pro-

jections **35G** which include individual pins **36G** for loose engagement into corresponding vertical grooves **24G** in the opposite inner end surface of the head frame **20G**. Further, the bearing projections **35G** are formed in their lower ends with recesses **37G** into which an upper end **62G** of a like chassis **60G** carrying the plucking head **40G** engages so that the guide frame **30G** is floatingly supported and is capable of being depressed together with the plucking head **40G**. Each of the bearing projections **35G** has a curved upper surface **38G** which is urged against an inner curved surface **25G** of an end flange **22G** of the head frame **20G**, as best shown in FIG. 5A, by the bias of a coil spring (not shown) acting to urge the plucking head **40G**. The curved upper surface **38G** of the bearing projection **35G** has a radius of curvature R2 which is less than a radius of curvature R1 of the inner curved surface **25G** of the head frame **20G** so that the bearing projection **35G** is engaged with the inner curved surface **25G** of the head frame only at a point of contact P which moves along the inner curved surface **25G** as the front bar **31G** is depressed. That is, when no depression force acts on the front bar **31G** as shown in FIG. 5A, the guide frame **30G** is kept in a neutral position as being urged upwardly together with the plucking head **40G** where the point of contact P lies on a vertical plane passing through the axis of the pin **36G** and through the point at which the guide frame **30G** receives the upward bias from the plucking head **40G**, leaving a distance B1 between the front bar **31G** pressed against the skin and the point of contact P. As a depression force F is applied to the front bar **31G** as a result of being pressed against the skin, as shown in FIG. 5B, the point of contact P moves away by a distance of H from the vertical plane. With this consequence, the guide frame **30G** is allowed to swing about thus moved point of contact P relative to the head frame **20G** with increased distance B2 between the front bar **31G** and the point of contact P, which accompanies a corresponding depressive movement of the plucking head **40G**. That is, as the front bar **31G** is depressed together with the roller **180**, the guide frame **30G** swings about the moving point of contact P with attendant depressive movement of the plucking head **40G**. With such combination of the swinging and depression movements, the front bar **31G** and the roller **180** can be kept in an optimum contact with the skin for alleviation of the pain. It is noted in this connection that the pins **36G** on the opposite ends of the guide frame **30G** are loosely and slidably engaged with the grooves **24G** in the head frame **20G** to allow the above combination movement of the guide frame **30G**.

[0018] The rollers **180** and **190** are preferred to be detachably mounted to the guide frame **30G** so that the user can select optimum rollers from a set of rollers of providing different stimuli on her preference. FIG. 3 illustrates one scheme for the detachable mounting of the rollers **190**, although it is equally applicable for the roller **180**. The roller **190** is received in the recess **194** with its

shaft **192** retained in bearing slots **193**. The bearing slot **193** is formed in its upper end with latches **195** which project inwardly to define an entrance of a width slightly narrower than the diameter of the shaft **192**. Due to resilient deformability inherently given to the plastic-made guide frame **30G**, the shaft **192** is allowed to pass through the entrance and is locked in the bearing slot **193** behind the latches **195** for easy attachment of the roller **190**. Likewise, the detachment of the roller can be made easily by the use of the resilient deformability. Although not shown in the figure, it is possible to make the bearing slots **193** deep enough and to provide additional latches intermediate its depth to latch the shaft **192** in the slots at different depth. With this design, it is made easy to adjust the projection amount of the roller or the bristles on the guide frame for selecting strong or weak mechanical stimuli from the rollers.

[0019] Although the rollers with the bristles are shown in the above, the present invention is not limited thereto and may include rollers of different configurations as explained below. A roller **200** in accordance with a first modification is shown in FIGS. 8A and 8B and comprises a plurality of elastic fins **201** spaced circumferentially and axially of the roller. The fin is made thinner toward its tip than at the root to be given elastic deformability for enhanced skin contact effect.

[0020] FIGS. 9A and 9B show a second modification of roller **210** with a combination of bristles **211** and elastic projections **212** which project radially with different radial lengths to define stimulus projections of applying different stimuli to the skin. The bristles **211** and the elastic projections **212** alternate in the circumferential direction and arranged along the axial length of the roller. The elastic projection may be a bundle of the bristles. With the use of the stimulus projections of different characteristics, it is possible to apply different kinds of mechanical stimuli to the skin for enhancing the alleviation of the hair plucking pain.

[0021] FIGS. 10A and 10B show a third modification of roller **220** with another combination of bristles **221** and elastic fins **222** which alternate in the circumferential direction. The elastic fins **222** is continuous over the substantial axial length of the roller **220** to apply the mechanical stimulus different from the bristles to the skin as it rotates on the skin.

[0022] FIGS. 11A and 11B show a fourth modification of roller **230** with a further combination of bristles **231** and rings **232** which alternate in the axial direction of the roller and apply different mechanical stimuli to the skin, respectively.

[0023] FIG. 12 shows a fifth modification of roller **240** with elastic fins **241** which are spaced circumferentially and axially of the roller with the width thereof aligned in the axial direction.

[0024] The features disclosed in the foregoing description, in the claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse

forms thereof within the scope of claim 1.

Claims

1. A hand-held depilating device for plucking hairs from the skin of a user, said depilating device comprising:

a housing (10G) adapted to be grasped by the hand of the user,
a plucking head (40G) mounted on top of said housing for plucking the hairs from the skin; and
at least one roller (131G; 180; 190; 200; 210; 220; 230; 240) rotatably mounted to said housing adjacent to said plucking head (40G) for rolling contact with the skin; said at least one roller providing mechanical stimuli to the skin while said plucking head operates to pluck the hairs;

characterised in that at least one of said rollers is provided with a plurality of stimulus projections (181; 191; 201; 211; 221, 231; 241).

2. The hand-held depilating device as set forth in claim 1, wherein said at least one roller (180; 190; 200; 210; 220; 230; 240) is floatingly supported to said housing to be capable of being depressed.

3. The hand-held depilating device as set forth in claim 1 or 2, wherein said stimulus projections are in the form of bristles (181; 191; 211; 221) projecting radially from said at least one roller.

4. The hand-held depilating device as set forth in claim 1 or 2, wherein said at least one roller (180; 190; 200; 210; 220; 230; 240) is carried on a skin guide frame (30G) which is floatingly supported to said housing to be capable of being depressed.

5. The hand-held depilating device as set forth in claim 1 or 2, wherein said at least one roller (180; 190; 200; 210; 220; 230; 240) is pivotally supported to said housing to be swingable about a swing axis.

6. The hand-held depilating device as set forth in claim 1 or 2, wherein adjusting means (193; 195) is provided to adjust a projection amount of said stimulus projections from the top of the housing.

7. The hand-held depilating device as set forth in claim 1 or 2, wherein said at least one roller (190) is detachably mounted to said housing.

8. The hand-held depilating device as set forth in claim 1 or 2, wherein said plucking head (40G) is floatingly supported to said housing (10G) to be capable of

being depressed, a skin guide frame (30G) being provided to surround said plucking head and comprise a main body (34G) which is connected to said plucking head to be capable of being depressed together therewith and a front guide (31 G) which is movably supported to said main body for limited displacement relative to said main body, and said at least one roller (180; 190; 200; 210; 220; 230; 240) being supported to said front guide.

9. The hand-held depilating device as set forth in claim 8, wherein said skin guide frame (30G) is supported to said housing so that it can swing about a swing axis (P) while being depressed together with said plucking head.

10. The hand-held depilating device as set forth in claim 9, wherein said skin guide frame (30G) is engaged at a point of contact (P) on a rounded portion (25G) of said housing, said point of contact defining said swing axis about which said skin guide frame can swing, said point of contact being capable of moving along said rounded portion (25G) as said skin guide frame swings and depressed.

11. The hand-held depilating device as set forth in claim 1, wherein one of said rollers in a smooth roller (131G).

Patentansprüche

1. Handenthaarungsvorrichtung zum Auszupfen von Haaren aus der Haut eines Benutzers, wobei die Enthaarungsvorrichtung umfaßt:

- ein Gehäuse (10G), das so ausgelegt ist, daß es von dem Benutzers in der Hand gehalten werden kann;
- ein Zupfkopf (40G), der an der Oberseite des Gehäuses zum Auszupfen der Haare aus der Haut montiert ist; und
- wenigstens eine Rolle (131G; 180; 190; 200; 210; 220; 230; 240), die angrenzend an den Zupfkopf (40G) für einen rollenden Kontakt mit der Haut drehbar befestigt ist; wobei die wenigstens eine Rolle mechanische Stimulationen auf die Haut ausübt, während der Zupfkopf für ein Auszupfen der Haare betrieben wird;

dadurch gekennzeichnet, daß wenigstens eine der Rollen mit einer Vielzahl von Stimulationsvorsprüngen (181; 191; 201; 211; 221; 231; 241) versehen ist.

2. Handenthaarungsvorrichtung nach Anspruch 1, wobei die wenigstens eine Rolle (180; 190; 200; 210; 220; 230; 240) frei beweglich an dem Gehäuse

gehalten ist, so daß sie niedergedrückt werden kann.

3. Handenthaarungsvorrichtung nach Anspruch 1 oder 2, wobei die Stimulationsvorsprünge in der Form von Borsten (181; 191; 211; 221) ausgebildet sind, die radial von der wenigstens einen Rolle hervorstehen. 5
4. Handenthaarungsvorrichtung nach Anspruch 1 oder 2, wobei die wenigstens eine Rolle (180; 190; 200; 210; 220; 230; 240) auf einem Hautführungsrahmen (30G) gehalten wird, der frei beweglich an dem Gehäuse gehalten wird, so daß er niedergedrückt werden kann. 10
5. Handenthaarungsvorrichtung nach Anspruch 1 oder 2, wobei die wenigstens eine Rolle (180; 190; 200; 210; 220; 230; 240) gelenkig an dem Gehäuse gehalten ist, so daß sie um eine Schwingachse schwenkbar ist. 15 20
6. Handenthaarungsvorrichtung nach Anspruch 1 oder 2, wobei eine Justiervorrichtung (193; 195) zur Einstellung des Ausmaßes eines Vorsprungs der Stimulationsvorsprünge gemessen von der Oberseite des Gehäuses zur Verfügung gestellt ist. 25
7. Handenthaarungsvorrichtung nach Anspruch 1 oder 2, wobei wenigstens eine Rolle (190) lösbar an dem Gehäuse montiert ist. 30
8. Handenthaarungsvorrichtung nach Anspruch 1 oder 2, wobei der Zupfkopf (40G) frei beweglich an dem Gehäuse (10G) gehalten ist, so daß er niedergedrückt werden kann, ein Hautführungsrahmen (30G) bereit gestellt ist, der den Zupfkopf umgibt und einen Hauptkörper (34G) umfaßt, der mit dem Zupfkopf verbunden ist, so daß er mit diesem gemeinsam niedergedrückt werden kann, und eine vordere Führung (31G) vorgesehen ist, die beweglich an dem Hauptkörper für einen begrenzten Versatz relativ zu dem Hauptkörper gehalten ist, und wobei die wenigstens eine Rolle (180; 190; 200; 210; 220; 230; 240) an der vorderen Führung gehalten ist. 35 40 45
9. Handenthaarungsvorrichtung nach Anspruch 8, wobei der Hautführungsrahmen (30G) an dem Gehäuse so gehalten ist, daß er um eine Schwingachse (P) schwingen kann, während er zusammen mit dem Zupfkopf niedergedrückt wird. 50
10. Handenthaarungsvorrichtung nach Anspruch 9, wobei der Hautführungsrahmen (30G) an einem Kontaktpunkt (P) mit einem abgerundeten Bereich (25G) des Gehäuses in Eingriff steht, wobei der Kontaktpunkt die Schwingachse definiert, um die 55

der Hautführungsrahmen schwingen kann und wobei der Kontaktpunkt in der Lage ist, sich längs des abgerundeten Bereiches (25G) zu bewegen, wenn der Hautführungsrahmen schwingt und niedergedrückt wird.

11. Handenthaarungsvorrichtung nach Anspruch 1, wobei eine der Rollen eine glatte Rolle (131G) ist.

Revendications

1. Dispositif d'épilation portatif destiné à arracher des poils de la peau d'un utilisateur, ledit dispositif d'épilation comprenant :

un boîtier (10G) conçu pour être saisi par la main de l'utilisateur,
une tête d'épilation (40G) montée sur le dessus dudit boîtier destinée à arracher les poils de la peau, et

au moins un rouleau (131G ; 180 ; 190 ; 200 ; 210 ; 220 ; 230 ; 240) monté avec possibilité de rotation sur ledit boîtier de façon adjacente à ladite tête d'épilation (40G) en vue d'un contact roulant avec la peau, ledit au moins un rouleau fournissant des stimuli mécaniques à la peau tandis que ladite tête d'épilation fonctionne pour arracher les poils,

caractérisé en ce qu'au moins l'un desdits rouleaux est muni d'une pluralité de saillies de stimuli (181 ; 191 ; 201 ; 211 ; 221 ; 231 ; 241).

2. Dispositif d'épilation portatif selon la revendication 1, dans lequel ledit au moins un rouleau (180 ; 190 ; 200 ; 210 ; 220 ; 230 ; 240) est supporté de façon flottante sur ledit boîtier pour pouvoir être enfoncé.
3. Dispositif d'épilation portatif selon la revendication 1 ou 2, dans lequel lesdites saillies de stimuli sont sous la forme de poils (181 ; 191 ; 211 ; 221) faisant saillie radialement à partir dudit au moins un rouleau.
4. Dispositif d'épilation portatif selon la revendication 1 ou 2, dans lequel ledit au moins un rouleau (180 ; 190 ; 200 ; 210 ; 220 ; 230 ; 240) est porté sur un cadre de guidage de peau (30G) qui est supporté de façon flottante sur ledit boîtier pour pouvoir être enfoncé.
5. Dispositif d'épilation portatif selon la revendication 1 ou 2, dans lequel ledit au moins un rouleau (180 ; 190 ; 200 ; 210 ; 220 ; 230 ; 240) est supporté avec possibilité de pivotement sur ledit boîtier pour pouvoir osciller autour d'un axe d'oscillation.

6. Dispositif d'épilation portatif selon la revendication 1 ou 2, dans lequel un moyen d'ajustement (193 ; 195) est prévu pour ajuster une valeur de saillie desdites saillies de stimuli depuis le dessus du boîtier. 5
7. Dispositif d'épilation portatif selon la revendication 1 ou 2, dans lequel ledit au moins un rouleau (190) est monté de façon amovible sur ledit boîtier. 10
8. Dispositif d'épilation portatif selon la revendication 1 ou 2, dans lequel ladite tête d'épilation (40G) est supportée de façon flottante sur ledit boîtier (10G) pour pouvoir être enfoncée, un cadre de guidage de peau (30G) étant prévu pour entourer ladite tête d'épilation et comprendre un corps principal (34G) qui est relié à ladite tête d'épilation pour pouvoir être enfoncé en même temps que celle-ci et un guide avant (31G) qui est supporté de façon mobile sur ledit corps principal en vue d'un déplacement limité par rapport audit corps principal, et ledit au moins un rouleau (180 ; 190 ; 200 ; 210 ; 220 ; 230 ; 240) étant supporté sur ledit guide avant. 15 20
9. Dispositif d'épilation portatif selon la revendication 8, dans lequel ledit cadre de guidage de peau (30G) est supporté sur ledit boîtier de sorte qu'il peut osciller autour d'un axe d'oscillation (P) tout en étant enfoncé en même temps que ladite tête d'épilation. 25 30
10. Dispositif d'épilation portatif selon la revendication 9, dans lequel ledit cadre de guidage de peau (30G) est mis en prise au niveau d'un point de contact (P) sur une partie arrondie (25G) dudit boîtier, ledit point de contact définissant ledit axe d'oscillation autour duquel ledit cadre de guidage de peau peut osciller, ledit point de contact pouvant se déplacer le long de ladite partie arrondie (25G) lorsque ledit cadre de guidage de peau oscille et est enfoncé. 35 40
11. Dispositif d'épilation portatif selon la revendication 1, dans lequel l'un desdits rouleaux est un rouleau lisse (131G). 45

50

55

FIG. 1

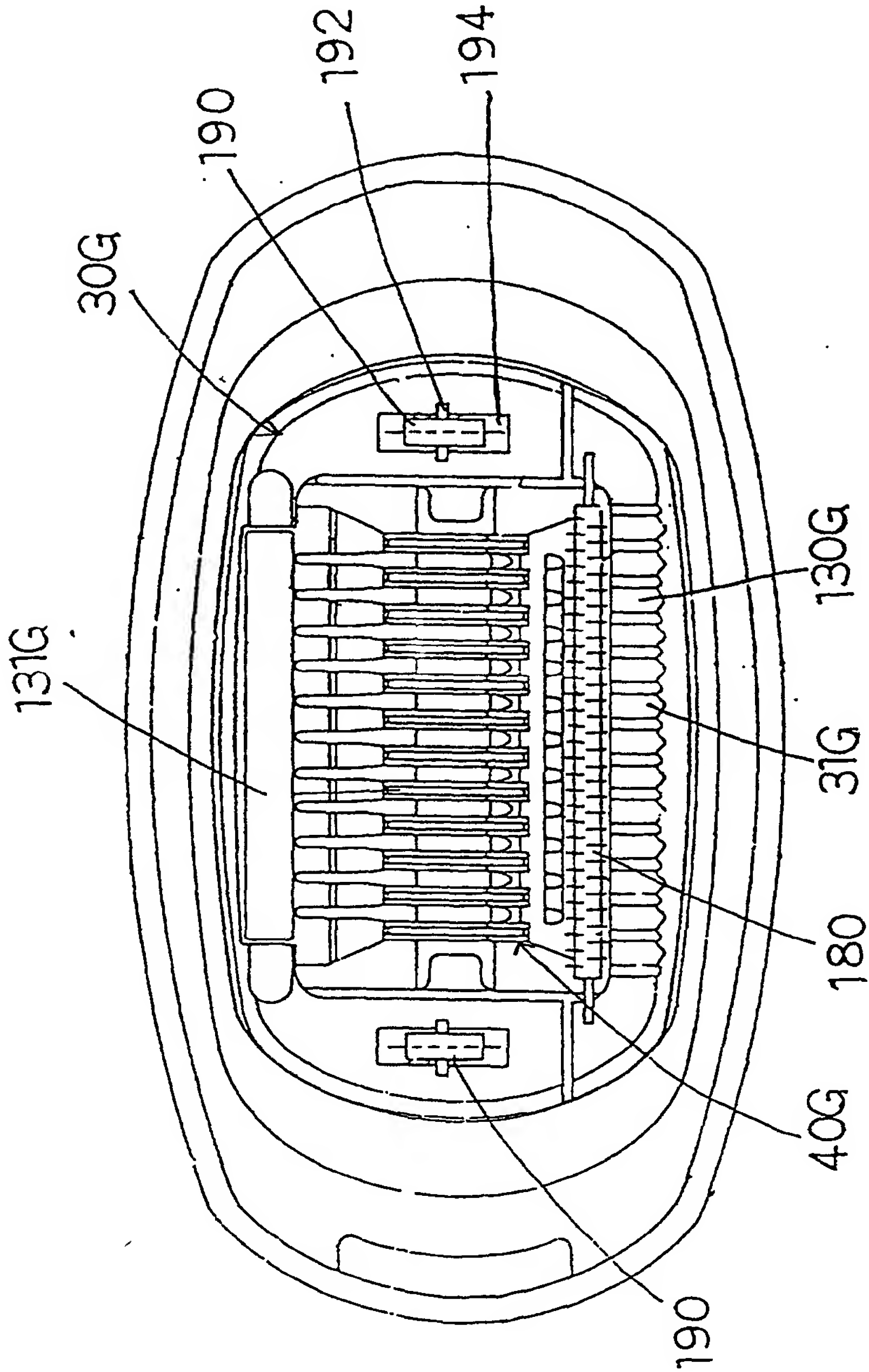


FIG. 2

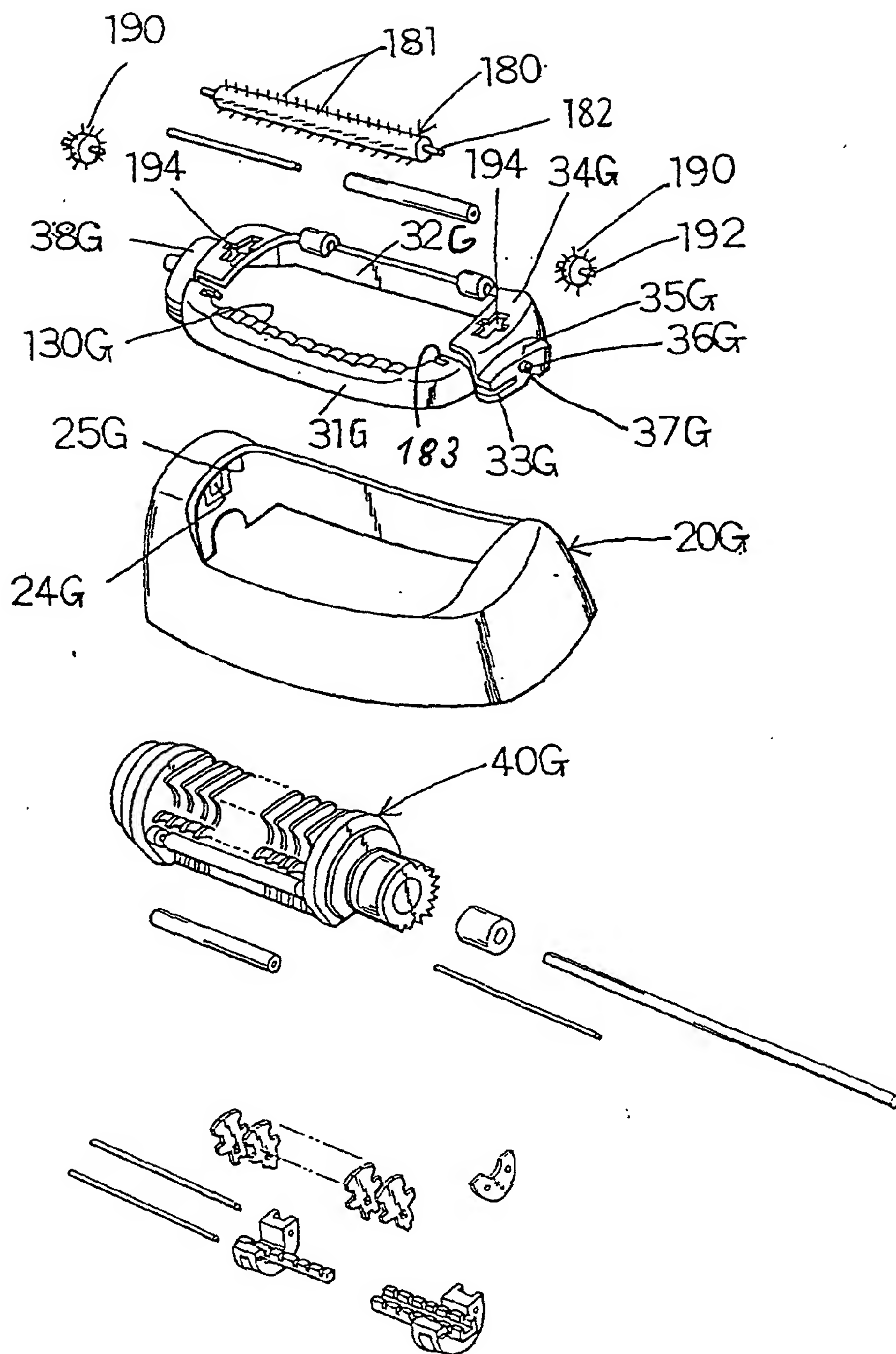


FIG. 3

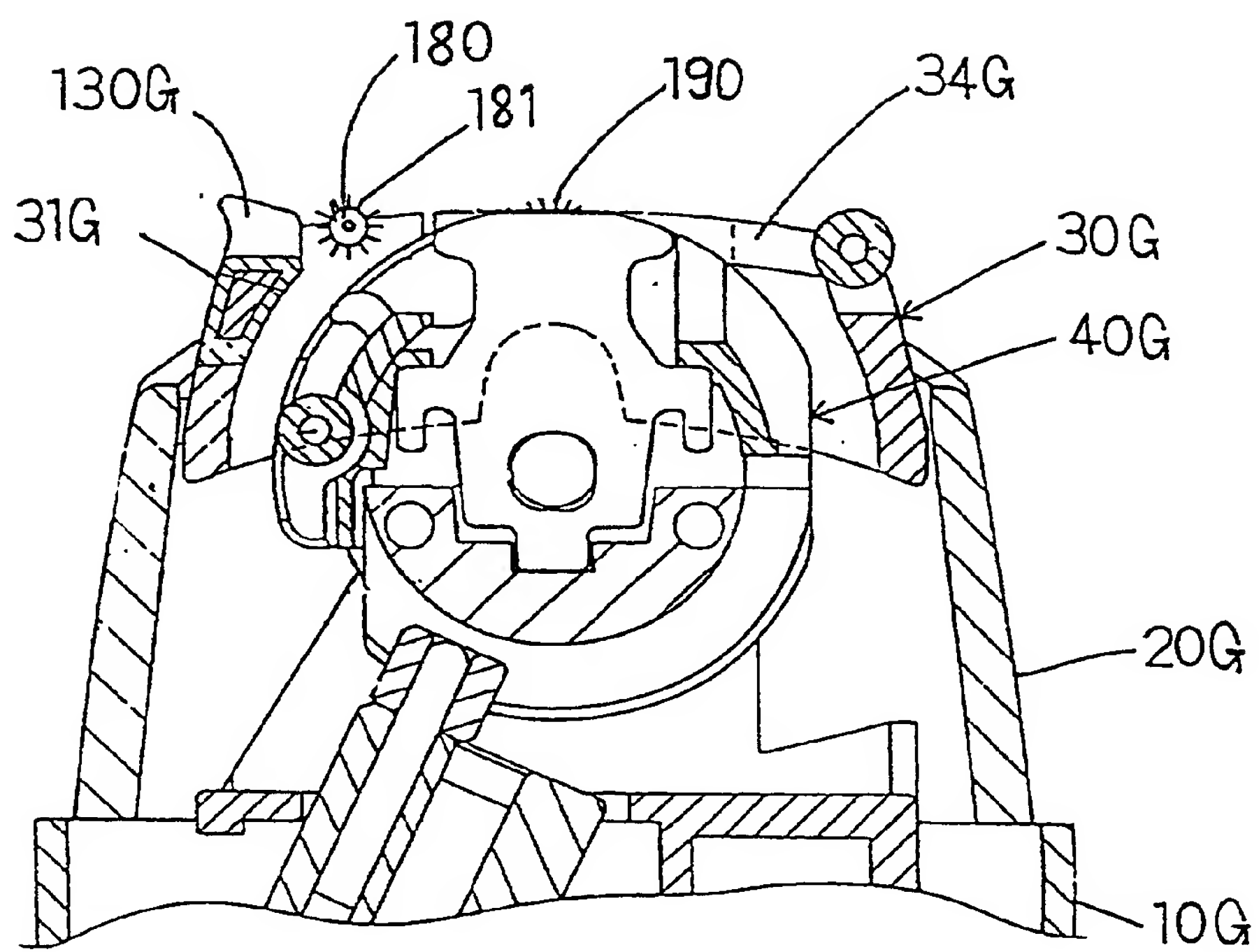


FIG. 4

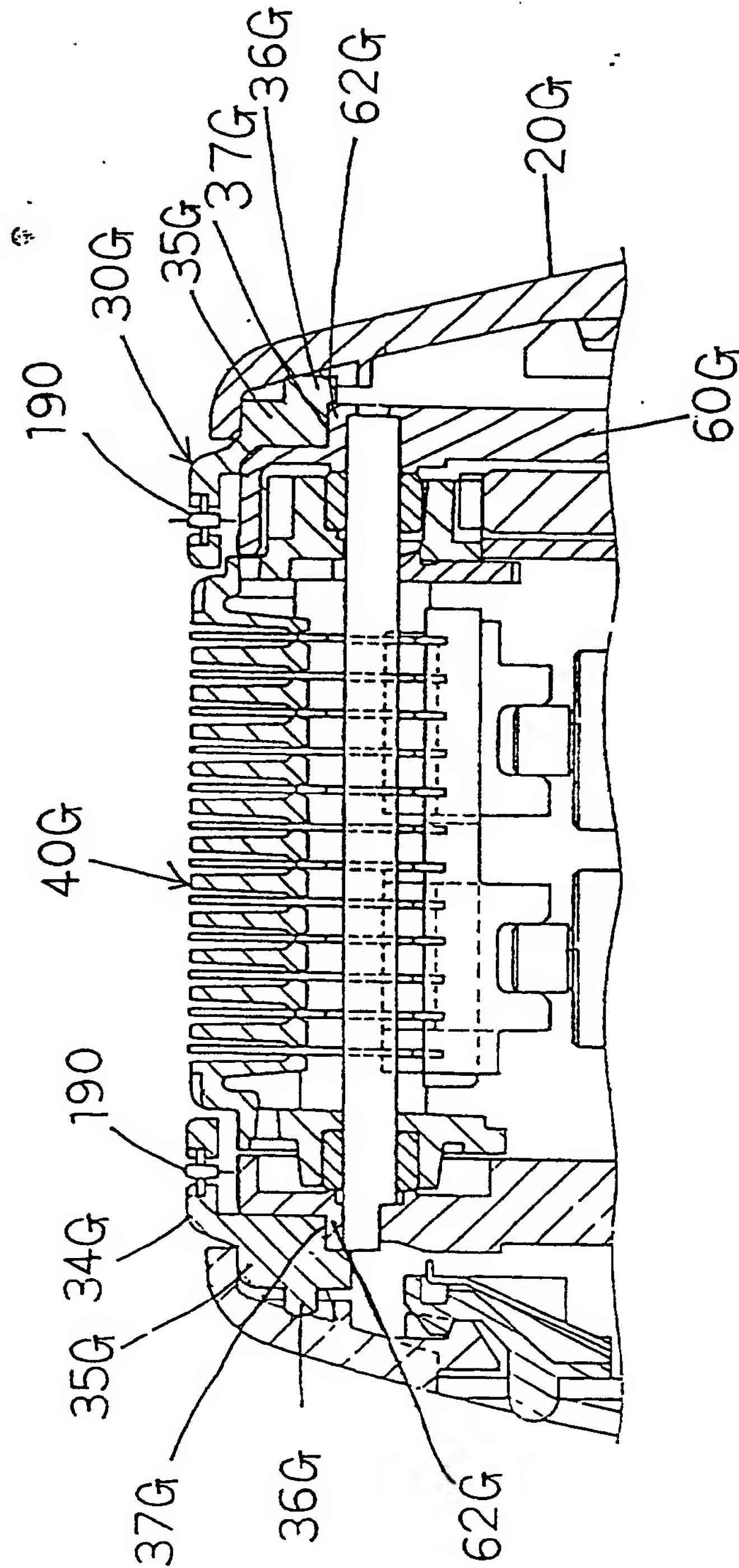


FIG. 5A

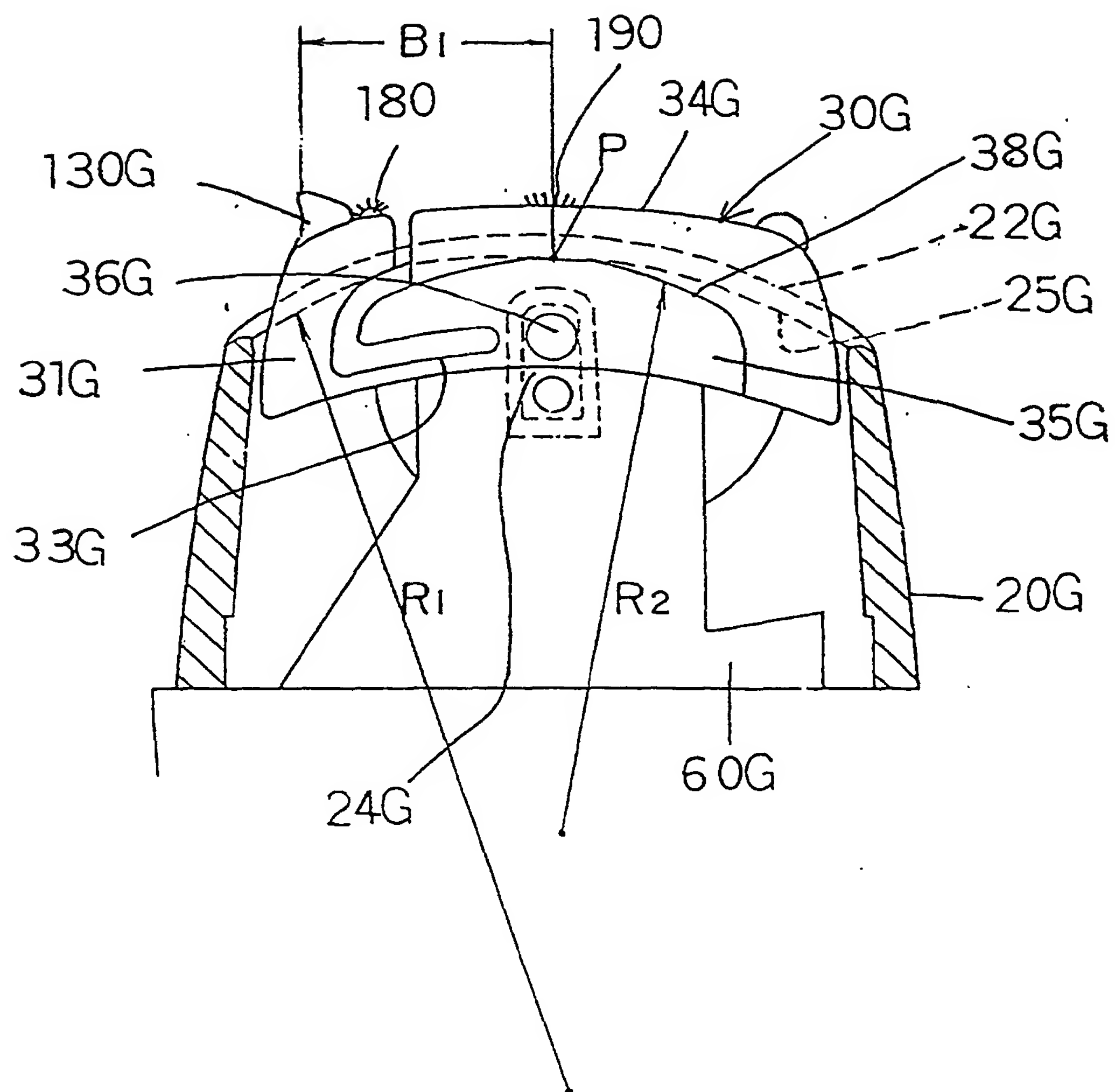
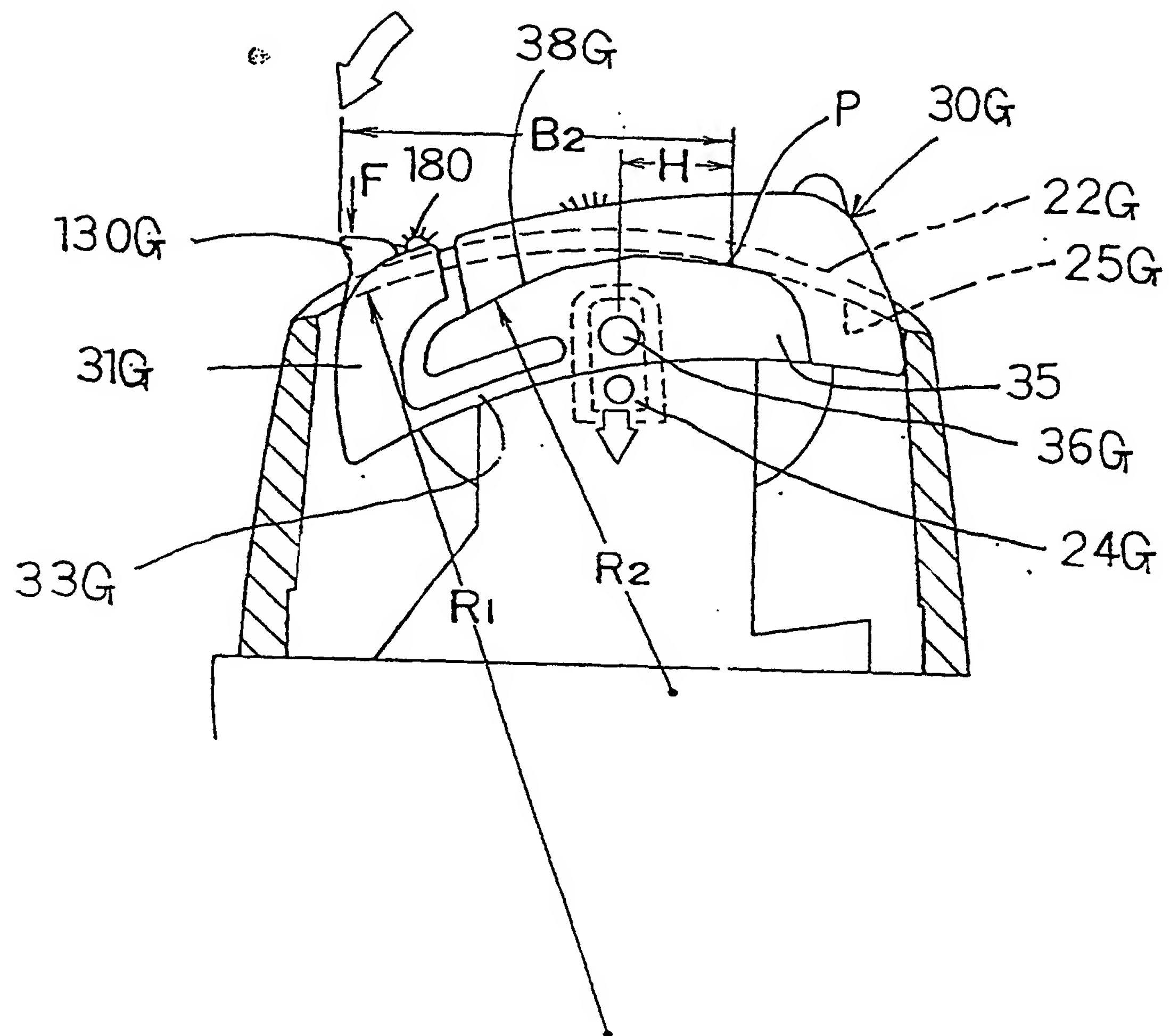


FIG. 5B



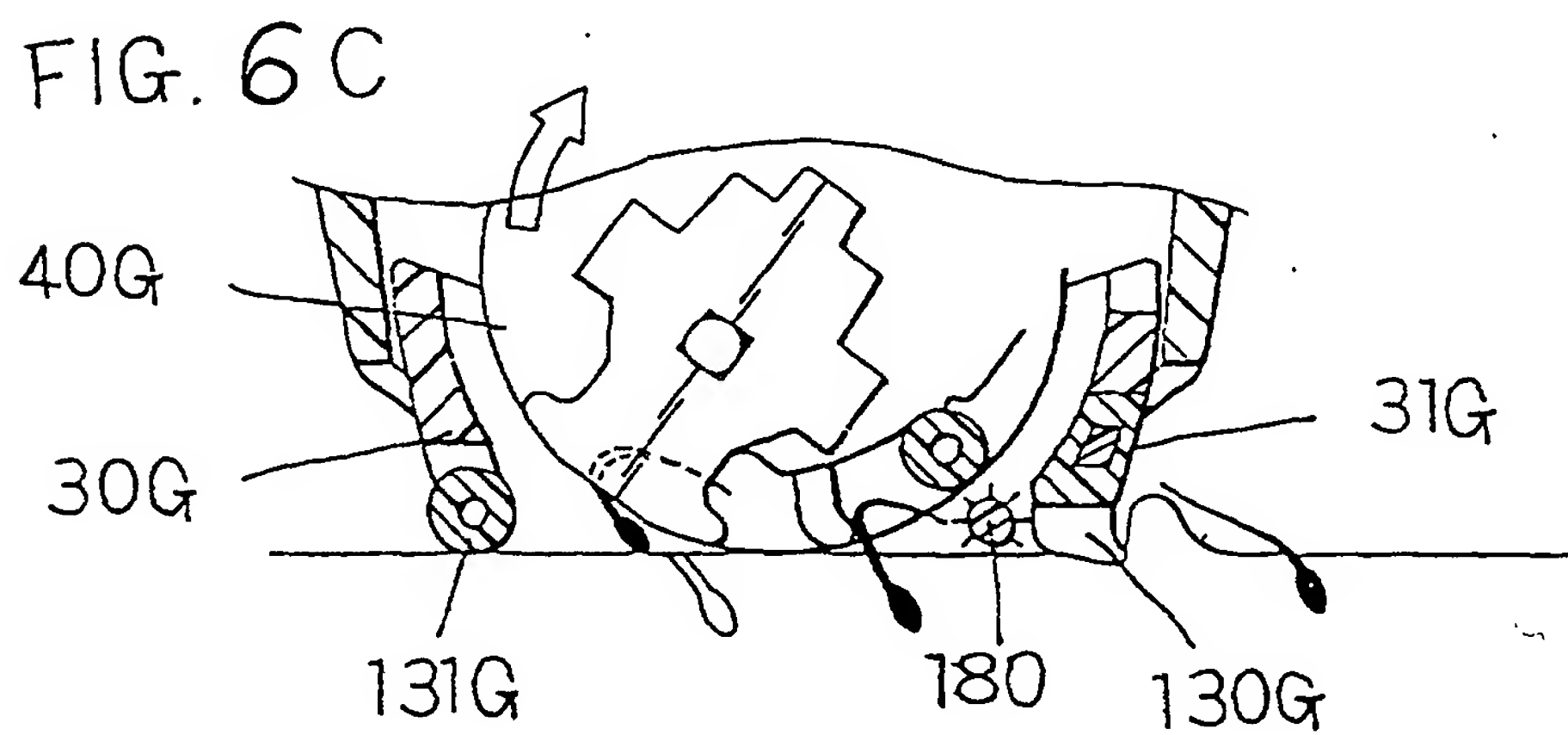
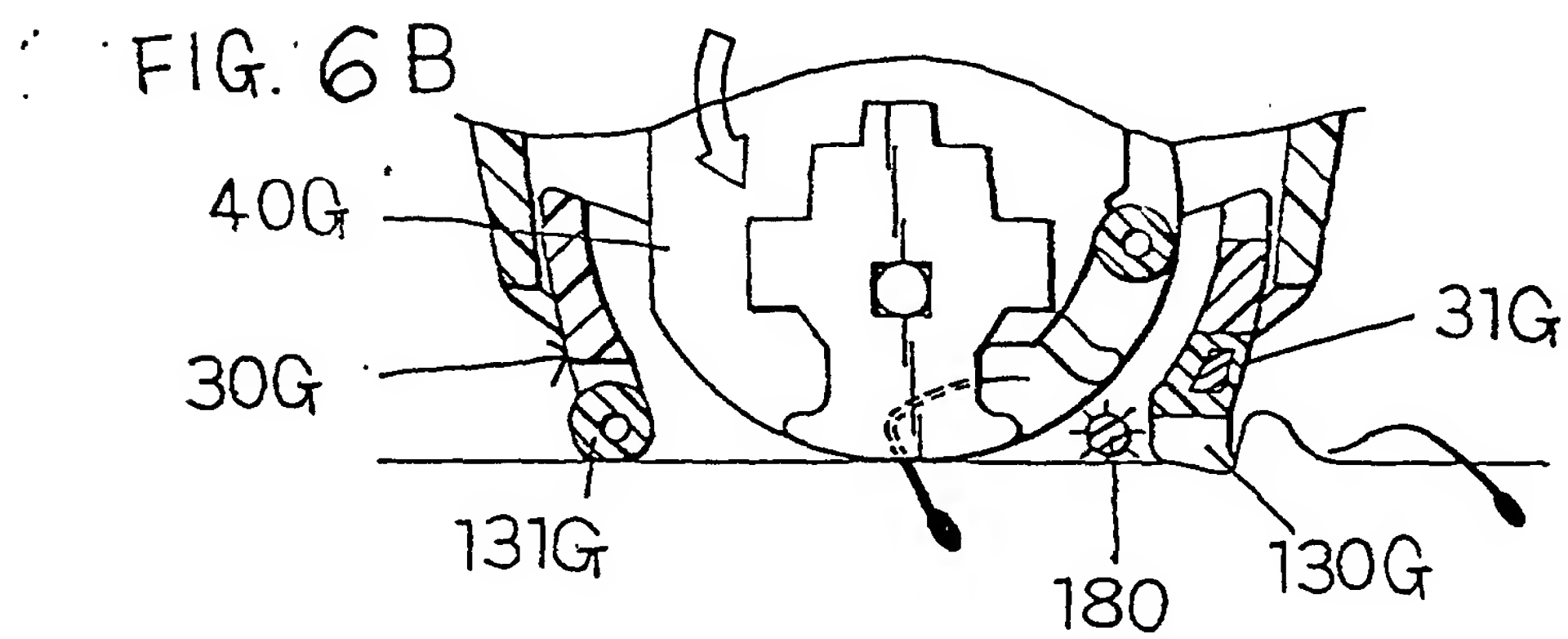
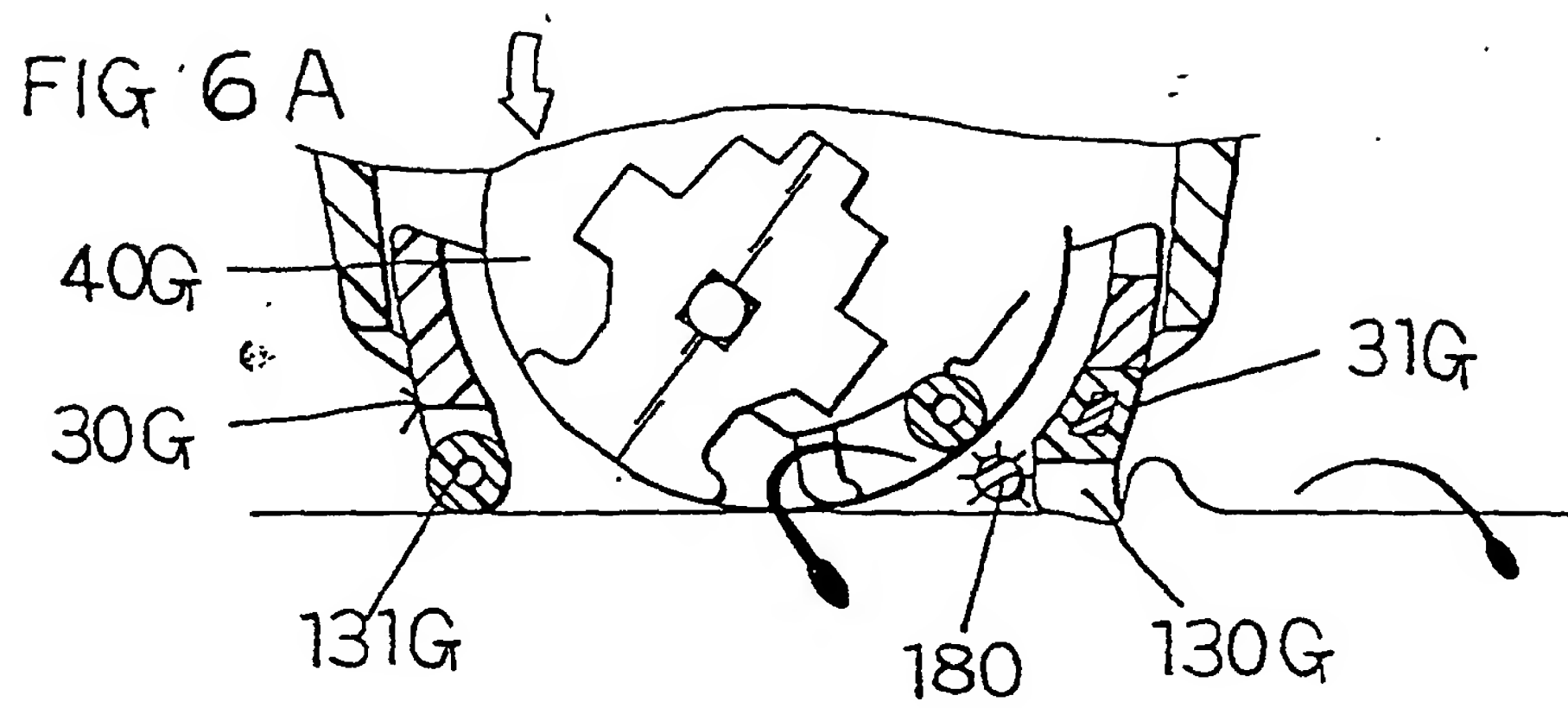
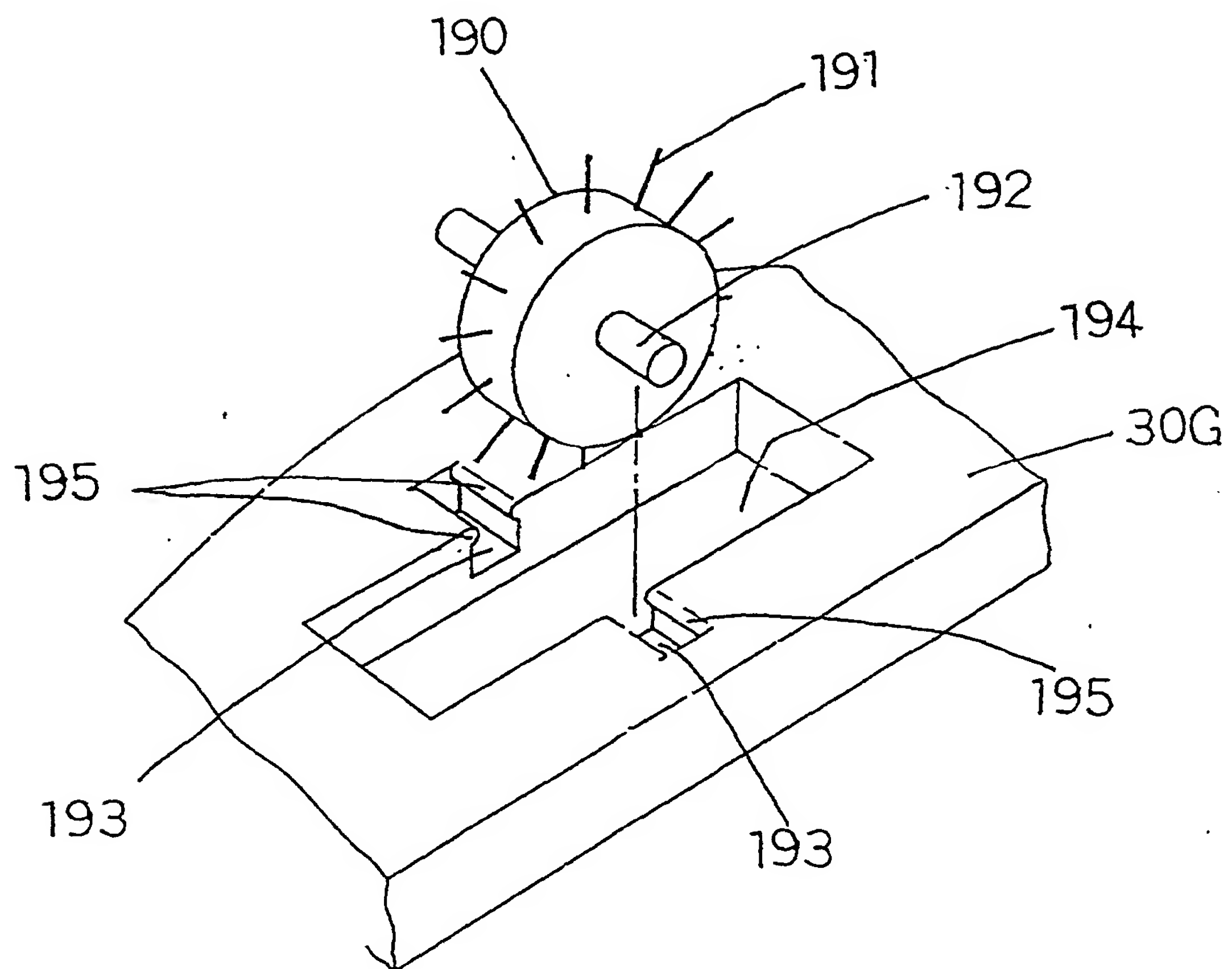


FIG. 7



6

FIG. 8A

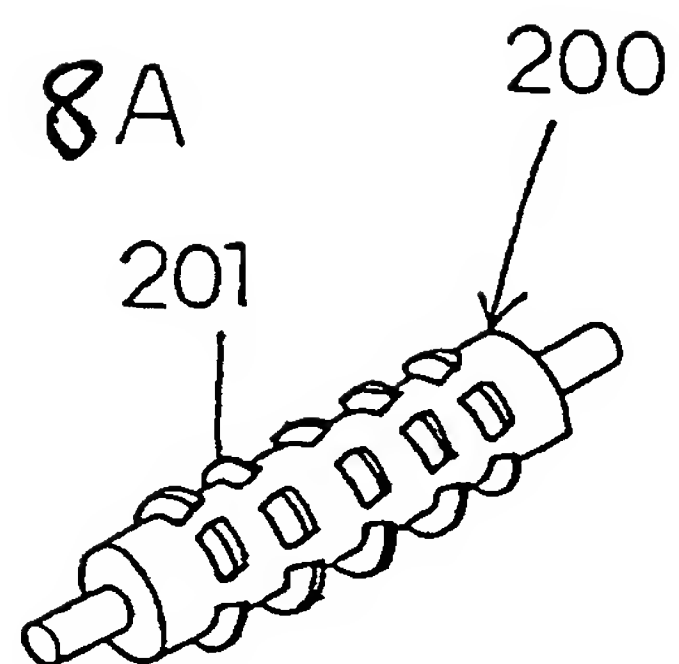


FIG. 8B

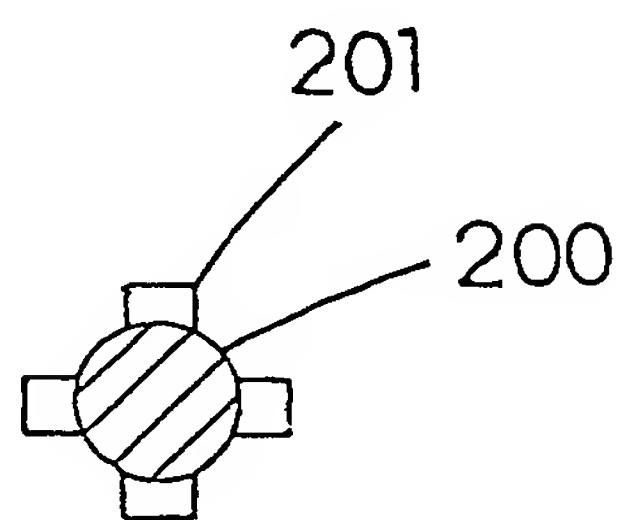


FIG. 9A

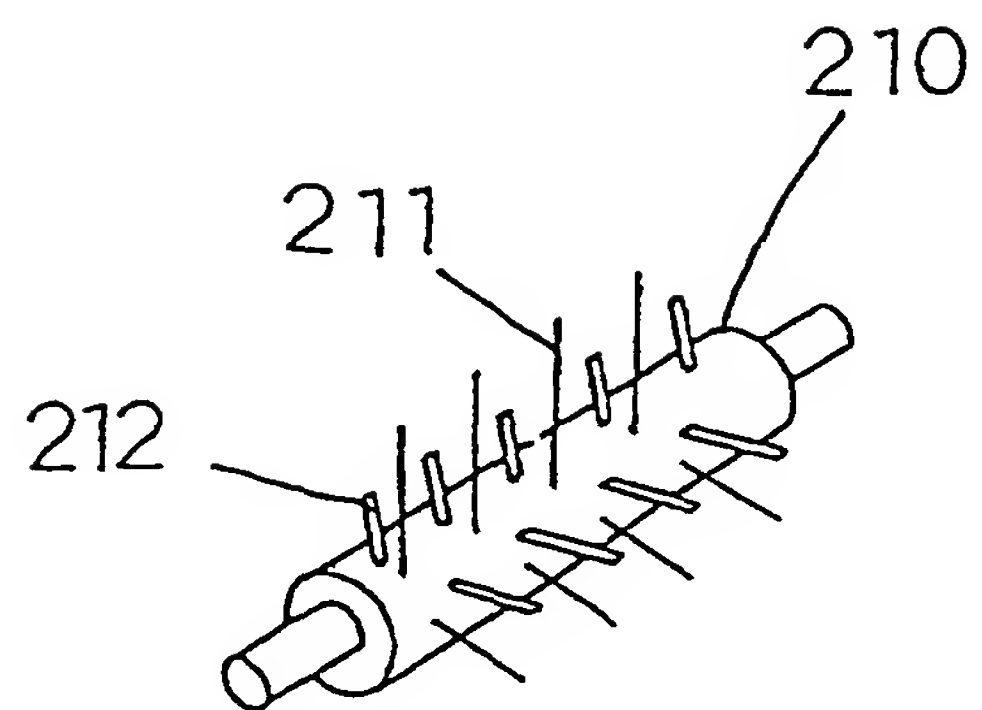


FIG. 9B

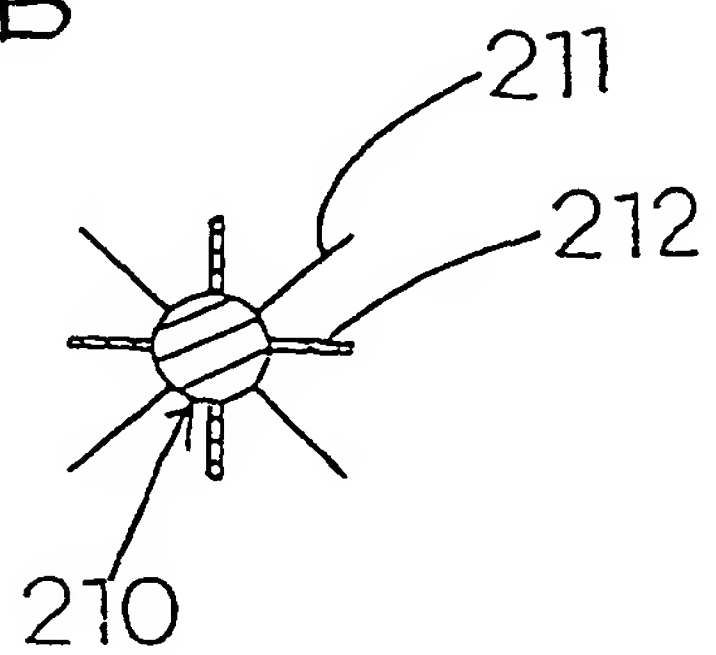


FIG. 10A

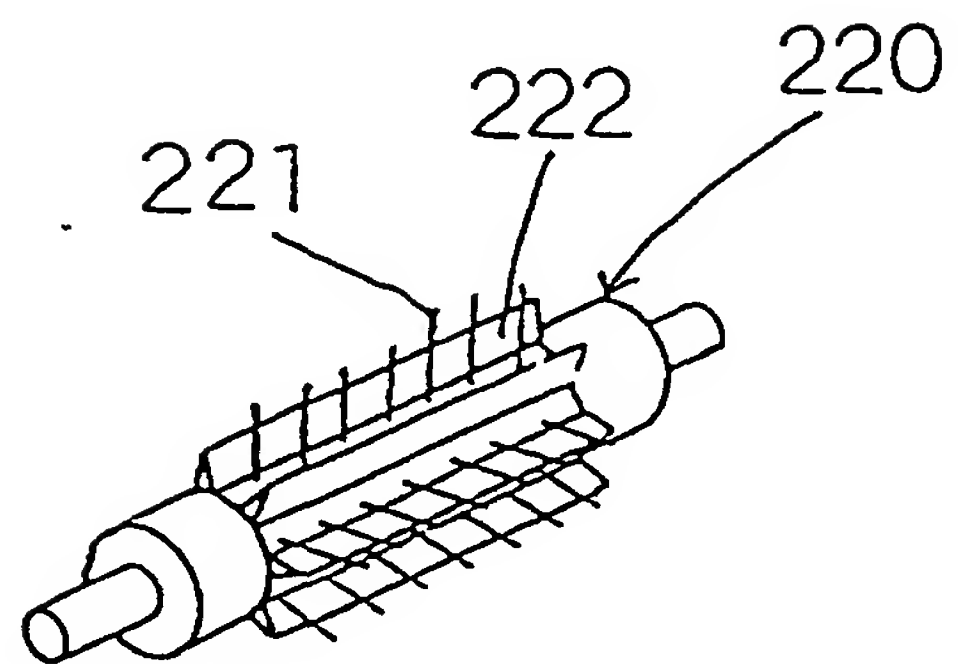


FIG. 10B

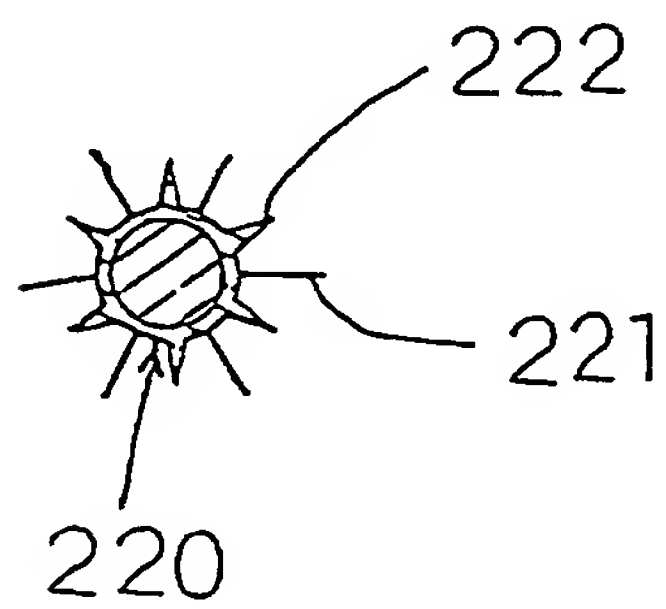


FIG. 11A

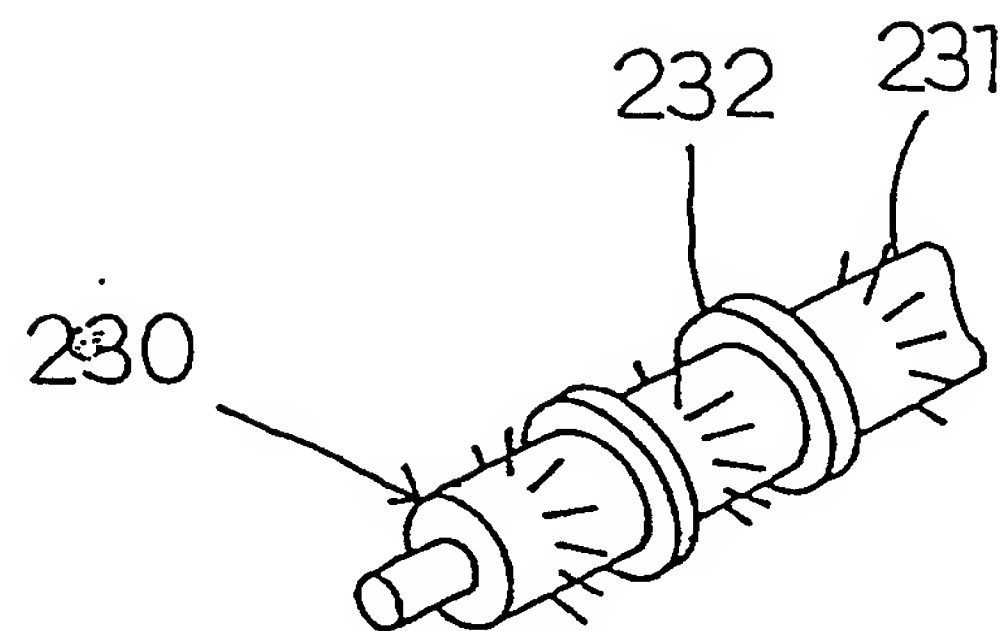


FIG. 11B

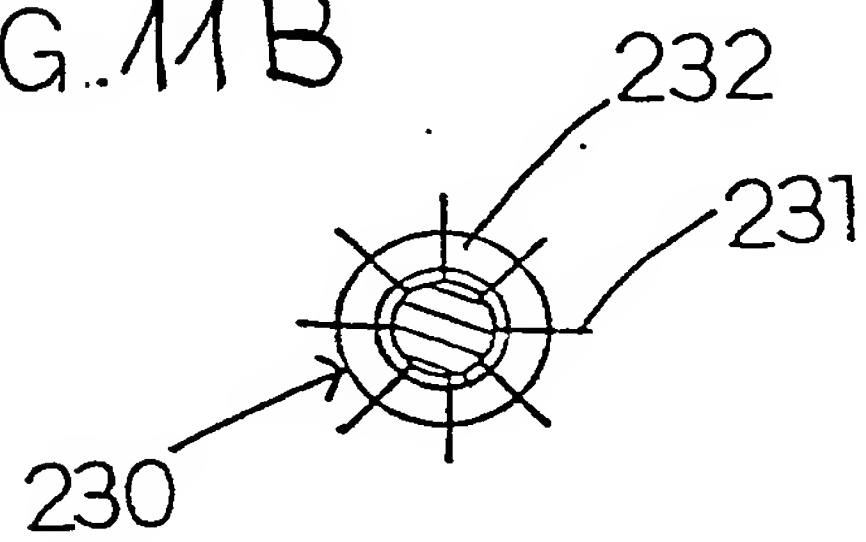


FIG. 12

